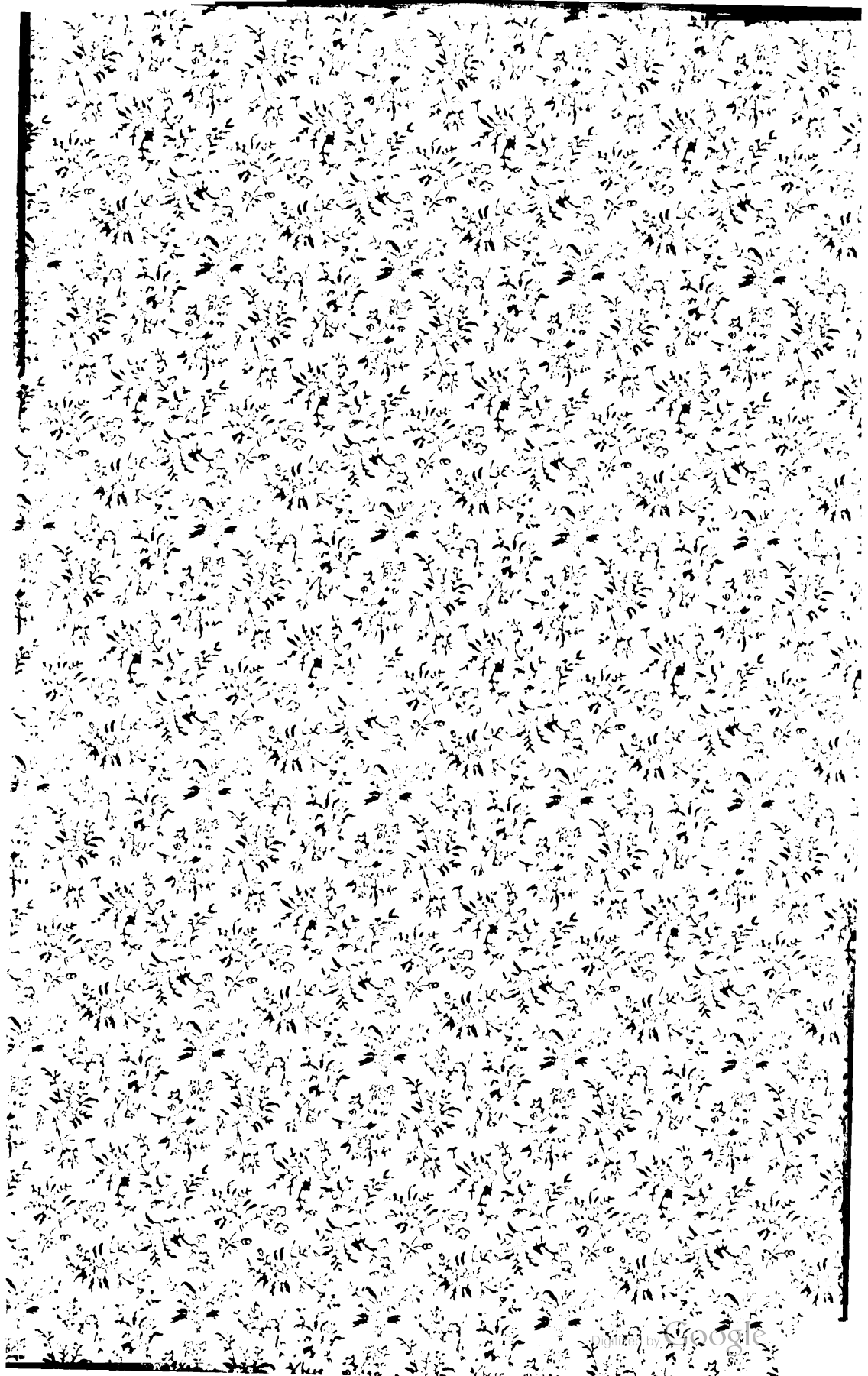

TRANSACTIONS

OF THE

CONGRESS

OF

American Physicians and Surgeons.

SEVENTH TRIENNIAL SESSION,

HELD AT

WASHINGTON, D. C.

May 7th, 8th, and 9th, 1907

PUBLISHED BY THE CONGRESS

NEW HAVEN, CONN.

1907.

Copies may be had of the Secretary.

THE TUTTLE, MOREHOUSE & TAYLOR COMPANY

TABLE OF CONTENTS.

PAPERS READ AT THE CONGRESS AND DISCUSSIONS.

OFFICERS OF THE CONGRESS

OF

1907.

PRESIDENT.

REGINALD H. FITZ, M.D., LL.D.; Boston, Mass.

VICE-PRESIDENTS, ex-officio.

DR. ARTHUR VAN HARLINGEN, Philadelphia, Pa.,
PRESIDENT OF THE AMERICAN DERMATOLOGICAL ASSOCIATION.

DR. ARTHUR W. DEROALDES, New Orleans, La.,
PRESIDENT OF THE AMERICAN LARYNGOLOGICAL ASSOCIATION.

DR. DUDLEY P. ALLEN, Cleveland, Ohio,
PRESIDENT OF THE AMERICAN SURGICAL ASSOCIATION.

DR. THOMAS DARLINGTON, New York City,
PRESIDENT OF THE AMERICAN CLIMATOLOGICAL ASSOCIATION.

DR. FRANCIS P. KINNICUTT, New York City,
PRESIDENT OF THE ASSOCIATION OF AMERICAN PHYSICIANS.

DR. WILLIAM K. OTIS, *deceased.*

DR. HARVEY G. MUDD, VICE-PRESIDENT, St. Louis, Mo.,
PRESIDENT OF THE AMERICAN ASSOCIATION OF GENITO-URINARY SURGEONS.

DR. JOEL E. GOLDTHWAIT, Boston, Mass.,
PRESIDENT OF THE AMERICAN ORTHOPEDIC ASSOCIATION.

DR. WILLIAM H. HOWELL, Baltimore, Md.,
PRESIDENT OF THE AMERICAN PHYSIOLOGICAL SOCIETY.

DR. B. K. RACHFORD, Cincinnati, Ohio,
PRESIDENT OF THE AMERICAN PEDIATRIC SOCIETY.

DR. CHARLES G. HILL, Baltimore, Md.,
PRESIDENT OF THE AMERICAN MEDICO-PSYCHOLOGICAL ASSOCIATION.

DR. WILLIAM H. WELCH, Baltimore, Md.,
PRESIDENT OF THE AMERICAN ASSOCIATION OF PATHOLOGISTS AND BACTERIOLOGISTS.

DR. CHARLES J. KIPP, Newark, N. J.,
PRESIDENT OF THE AMERICAN OPHTHALMOLOGICAL SOCIETY.

DR. EMIL GRUENING, New York City,
PRESIDENT OF THE AMERICAN OTOLOGICAL SOCIETY.

DR. HUGH T. PATRICK, Chicago, Ill.,
PRESIDENT OF THE AMERICAN NEUROLOGICAL ASSOCIATION.

DR. CLEMENT CLEVELAND, New York City,
PRESIDENT OF THE AMERICAN GYNECOLOGICAL SOCIETY.

TREASURER.
NEWTON M. SHAFFER, M.D.;
New York City.

SECRETARY.
WILLIAM H. CARMALT, M.D.,
New Haven, Conn.

EXECUTIVE COMMITTEE.

DR. CHARLES S. BULL, *Delegate,* New York City.
DR. J. D. RUSHMORE, *Alternate,* Brooklyn, N. Y.
Representing the AMERICAN OPHTHALMOLOGICAL SOCIETY.

DR. WILLIAM H. CARMALT, *Delegate,* New Haven, Conn.
CHAIRMAN OF THE EXECUTIVE COMMITTEE.
DR. F. B. LORING, *Alternate,* Washington, D. C.
Representing the AMERICAN OTOLOGICAL SOCIETY.

DR. CHARLES L. DANA, *Delegate,* New York City.
DR. GEORGE L. WALTON, *Alternate,* Boston, Mass.
Representing the AMERICAN NEUROLOGICAL ASSOCIATION.

DR. EDWARD REYNOLDS, *Delegate,* Boston, Mass.
Representing the AMERICAN GYNECOLOGICAL SOCIETY.

DR. JAMES NEVINS HYDE, *Delegate,* Chicago, Ill.
DR. JOHN A. FORDYCE, *Alternate,* New York City.
Representing the AMERICAN DERMATOLOGICAL ASSOCIATION.

DR. WM. K. SIMPSON, *Delegate,* New York City.
SECRETARY OF THE EXECUTIVE COMMITTEE.
DR. G. HUDSON MAKUEN, *Alternate,* Philadelphia, Pa.
Representing the AMERICAN LARYNGOLOGICAL ASSOCIATION.

DR. WILLIAM W. KEEN, *Delegate,* Philadelphia, Pa.
DR. ANDREW J. McCOSH, *Alternate,* New York City.
Representing the AMERICAN SURGICAL ASSOCIATION.

DR. FRED'K. I. KNIGHT, *Delegate,* Boston, Mass.
DR. ROLAND G. CURTIN, *Alternate,* Philadelphia, Pa.
Representing the AMERICAN CLIMATOLOGICAL ASSOCIATION.

DR. WM. OSLER, *Delegate,* Oxford, Eng.
DR. F. H. WILLIAMS, *Alternate,* Boston, Mass.
Representing the ASSOCIATION OF AMERICAN PHYSICIANS.

DR. ARTHUR T. CABOT, *Delegate,* Boston, Mass.
Representing the AMERICAN ASSOCIATION OF GENITO-URINARY SURGEONS.

DR. WISNER R. TOWNSEND, *Delegate,* New York City.
DR. ROBT. W. LOVETT, *Alternate,* Boston, Mass.
Representing the AMERICAN ORTHOPEDIC ASSOCIATION.

PROF. R. H. CHITTENDEN, *Delegate,* New Haven, Conn.
DR. W. T. PORTER, *Alternate,* Boston, Mass.
Representing the AMERICAN PHYSIOLOGICAL SOCIETY.

DR. ABRAHAM JACOBI, *Delegate,* New York City.
DR. J. P. CROZER-GRIFFITH, *Alternate,* Philadelphia, Pa.
Representing the AMERICAN PEDIATRIC SOCIETY.

DR. ALEXANDER G. MACDONALD, *Delegate,* New York City, *deceased.*
DR. E. N. BRUSH, *Alternate,* Baltimore, Md.
Representing the AMERICAN MEDICO-PSYCHOLOGICAL ASSOCIATION.

DR. HAROLD C. ERNST, *Delegate,* Boston, Mass.
Representing the AMERICAN ASSOCIATION FOR PATHOLOGISTS AND BACTERIOLOGISTS.

COMMITTEE OF ARRANGEMENTS.

DR. FRANCIS B. LORING, 1420 K st., Washington, D. C.
Of the AMERICAN OPHTHALMOLOGICAL SOCIETY.

DR. S. O. RICHEY, 732 Seventeenth st., Washington, D. C.
Of the AMERICAN OTOLOGICAL SOCIETY.

DR. H. M. THOMAS, 1228 Madison ave., Baltimore, Md.
Of the AMERICAN NEUROLOGICAL ASSOCIATION.

DR. JOSEPH TABER JOHNSON, 935 Farragut square, Washington, D. C.
Of the AMERICAN GYNECOLOGICAL SOCIETY.

DR. FRANCIS J. SHEPHERD, 152 Mansfield st., Montreal, Ontario.
Of the AMERICAN DERMATOLOGICAL ASSOCIATION.

DR. JOHN H. BRYAN, 818 Seventeenth st., Washington, D. C.
Of the AMERICAN LARYNGOLOGICAL ASSOCIATION.

DR. GEORGE TULLY VAUGHAN, 1718 I st., Washington, D. C.
Of the AMERICAN SURGICAL ASSOCIATION.

DR. W. F. R. PHILLIPS, Medical Department, George Washington University, Washington, D. C.
Of the AMERICAN CLIMATOLOGICAL ASSOCIATION.

DR. GEORGE M. KOBER, 1600 T st., Washington, D. C.
Of the ASSOCIATION OF AMERICAN PHYSICIANS.

DR. HUGH H. YOUNG, 1005 North Charles st., Baltimore, Md.
Of the AMERICAN ASSOCIATION OF GENITO-URINARY SURGEONS.

DR. A. R. SHANDS, 901 Sixteenth st., NW., Washington, D. C.
CHAIRMAN OF COMMITTEE OF ARRANGEMENTS
Of the AMERICAN ORTHOPEDIC ASSOCIATION.

DR. W. H. HOWELL, Johns Hopkins University, Baltimore, Md.
Of the AMERICAN PHYSIOLOGICAL SOCIETY.

DR. S. S. ADAMS, 1 Dupont Circle, Washington, D. C.
Of the AMERICAN PEDIATRIC SOCIETY.

DR. WILLIAM A. WHITE, Supt. Government Hospital for the Insane, Washington, D. C.
Of the AMERICAN MEDICO-PSYCHOLOGICAL ASSOCIATION.

DR. JAMES CARROLL, Army Medical Museum, Washington, D. C.
Of the AMERICAN ASSOCIATION OF PATHOLOGISTS AND BACTERIOLOGISTS.

MINUTES.

The seventh triennial session of the CONGRESS OF AMERICAN PHYSICIANS AND SURGEONS took place in Washington, D. C., May 7th, 8th and 9th, 1907, in the convention hall of the Arlington Hotel. The first meeting was called to order at 4 P. M., Tuesday, May 7th, by the President, Dr. Reginald H. Fitz, of Boston, who announced the subject to be considered: "The Historical Development and Relative Value of Laboratory and Clinical Methods in Diagnosis," and announced Dr. William Osler, of Oxford, England, who read a paper entitled "The Evolution of the Idea of Experiment in the Study of Medicine," (page 1). He was followed by Dr. Lewellys F. Barker, of Baltimore, Md., upon "Neurological and Psychiatric Diagnosis," (page 9); by Dr. Alfred Stengel, of Philadelphia, Pa., upon "Chemical and Biological Diagnosis," (page 17), and by Dr. Richard H. Cabot, of Boston, Mass., upon "Physical Diagnosis," (page 48). These papers were followed by a discussion by Dr. George Blumer of New Haven, Conn.

EVENING SESSION, 8:30 P. M.

The meeting was called to order by Dr. Thomas Darlington, President of the American Climatological Association and *ex-officio* Vice-President of the Congress, who announced the address by the President of the Congress, Dr. Reginald H. Fitz, Boston, on "The Borderland of Medicine and Surgery," (page 136).

WEDNESDAY, MAY 8TH.

The meeting was called to order at 3 P. M., by the President, Dr. Reginald H. Fitz, Boston.

Subject considered: "The Comparative Value of the Medical and Surgical Treatment of the Immediate and Remote Results of Ulcer of the Stomach."

Papers were read by Dr. John H. Musser, of Philadelphia, "On the Medical vs. Surgical Treatment of Gastric Ulcer," (page 56), and by Dr. Charles G. Stockton, of Buffalo, N. Y., "On the

Indications for, the Methods of, and the Results to be Expected in the Medicinal Treatment;" (page 94); by Dr. William J. Mayo, of Rochester, Minn., "On the Contributions of Surgery to the better Understanding of Gastric and Duodenal Ulcer;" (page 102), and by Dr. John C. Munro, of Boston, Mass., "On a Consideration of the End-Results in Benign Lesions of the Stomach, Surgically Treated;" (page 109). These papers were followed in discussion by Drs. A. Jacobi, (page 116), and Edward G. Janeway, (page 132), of New York.

At the close of the meeting Dr. Frank Billings, on behalf of "Presidents of the Congress, and Presidents of its constituent associations," presented to the Secretary, Dr. William H. Carmalt, a silver cup, in appreciation of his "faithful and untiring services" in behalf of the organization.

Dr. Carmalt replied that he had not dreamed that his efforts could be so highly appreciated and said "I can only thank you sincerely for this manifestation, but feel that it is undeserved."

Adjournment.

GUESTS OF THE CONGRESS.

By Invitation of the Executive Committee.

Brigadier General Robert M. O'Reilly, M.D.,
Surgeon General United States Army.
Rear Admiral Presley M. Rixey, M.D.,
Surgeon General United States Navy.
Walter Wyman, M.D.,
Surgeon General of the Public Health and Marine Hospital Service.
Professor E. Kuster, M.D.,
Professor of Surgery in the University of Marburg, Germany.
Professor L. Killian, M.D.,
Professor of Laryngology in the University of Freiburg, Germany.

MEMBERS OF THE CONGRESS.

Members present are indicated by *.

AMERICAN OPHTHALMOLOGICAL SOCIETY.

Organized 1864.

ACTIVE MEMBERS AND ASSOCIATES.

*Dr. A. E. Adams,	Newburg, New York.
*Dr. J. L. Adams,	New York City.
Dr. L. A. W. Alleman,	Brooklyn, New York.
Dr. A. N. Alling,	New Haven, Connecticut.
*Dr. G. W. Allyn,	Pittsburg, Pennsylvania.
Dr. A. Alt,	St. Louis, Missouri.
*Dr. J. A. Andrews,	Santa Barbara, California.
*Dr. S. C. Ayres,	Cincinnati, Ohio.
Dr. C. H. Beard,†	Chicago, Illinois.
Dr. Jas. H. Bell,†	San Antonio, Texas.
Dr. H. W. Bradford,	Wolfboro, New Hampshire.
Dr. Gustave E. Bruère,†	Portland, Oregon.
Dr. Wm. E. Bruner,†	Cleveland, Ohio.
Dr. H. D. Bruns,†	New Orleans, Louisiana.
*Dr. Charles S. Bull,	New York City.
*Dr. W. K. Butler,	Washington, D. C.
*Dr. W. Gordon M. Byers,†	Montreal, Canada.
Dr. Peter A. Callan,	New York City.
Dr. F. P. Capron,	Providence, Rhode Island.
Dr. W. M. Carhart,†	New York City.
*Dr. W. H. Carmalt,	New Haven, Connecticut.
Dr. John T. Carpenter, Jr.,	Philadelphia, Pennsylvania.

*Dr. Burton K. Chance,†	Philadelphia, Pennsylvania.
Dr. H. B. Chandler,	Boston, Massachusetts.
*Dr. J. W. Charles,	St. Louis, Missouri.
Dr. Wm. Cheatham,	Louisville, Kentucky.
Dr. F. E. Cheney,	Boston, Massachusetts.
Dr. J. H. Claiborne,	New York City.
*Dr. C. F. Clark,	Columbus, Ohio.
Dr. David Coggin,	Salem, Massachusetts.
Dr. Wm. G. Craig,	Springfield, Massachusetts.
*Dr. C. M. Culver,	Albany, New York.
*Dr. R. J. Curdy,†	Kansas City, Missouri.
*Dr. C. W. Cutler,	New York City.
Dr. A. E. Davis,†	New York City.
Dr. W. S. Dennett,	New York City.
Dr. Hasket Derby,	Boston, Massachusetts.
Dr. Lewis S. Dixon,	Boston, Massachusetts.
*Dr. Alexander Duane,	New York City.
Dr. J. B. Emerson,	New York City.
Dr. Arthur E. Ewing,	St. Louis, Missouri.
Dr. T. H. Fenton,	Philadelphia, Pennsylvania.
*Dr. George F. Fiske,	Chicago, Illinois.
*Dr. W. H. Fox,†	Washington, D. C.
Dr. Percy Fridenberg,	New York City.
*Dr. H. Friedenwald,	Baltimore, Maryland.
Dr. B. F. Fryer,	Kansas City, Missouri.
Dr. G. M. Gould,	Philadelphia, Pennsylvania.
Dr. H. Y. Grant,	Buffalo, New York.
Dr. John Green,	St. Louis, Missouri.
*Dr. Allen Greenwood,†	Boston, Massachusetts.
*Dr. Emil Gruening,	New York City.
Dr. C. W. Haddock,†	Beverly, Massachusetts.
*Dr. G. W. Hale,	Nashville, Tennessee.
Dr. Wm. D. Hall,	Boston, Massachusetts.
*Dr. H. F. Hansell,	Philadelphia, Pennsylvania.
Dr. George C. Harlan,	Philadelphia, Pennsylvania.
*Dr. Herbert Harlan,	Baltimore, Maryland.
Dr. David Harrower,	Worcester, Massachusetts.
Dr. N. D. Harvey,	Providence, Rhode Island.
*Dr. H. H. Haskell,	Boston, Massachusetts.
Dr. Gustavus Hay,	Jamaica Plains, Massachusetts.
*Dr. Neil J. Hepburn,	New York City.
*Dr. Ward Holden,	New York City.
*Dr. C. R. Holmes,†	Cincinnati, Ohio.
Dr. E. E. Holt,	Portland, Maine.
*Dr. Lucien Howe,	Buffalo, New York.
*Dr. A. A. Hubbell,	Buffalo, New York.
*Dr. D. W. Hunter,	New York City.
*Dr. J. W. Ingalls,	Brooklyn, New York.

*Dr. E. E. Jack,	Boston, Massachusetts.
*Dr. Edward Jackson,	Denver, Colorado.
Dr. B. Joy Jeffries,	Boston, Massachusetts.
*Dr. W. B. Johnson,	Paterson, New Jersey.
*Dr. H. W. Kilburn,	Boston, Massachusetts.
*Dr. Charles J. Kipp,	Newark, New Jersey.
*Dr. Arnold Knapp,	New York City.
Dr. H. Knapp,	New York City.
Dr. Carl Koller,	New York City.
Dr. Chas. W. Kollock,	Charleston, South Carolina.
*Dr. W. E. Lambert,	New York City.
Dr. W. B. Lancaster,†	Amherst, Massachusetts.
*Dr. J. C. Lester,†	Brooklyn, New York.
Dr. F. N. Lewis,	New York City.
Dr. G. F. Libby,†	Denver, Colorado.
Dr. J. A. Lippincott,	Pittsburg, Pennsylvania.
*Dr. F. B. Loring,	Washington, D. C.
Dr. D. B. Lovell,	Worcester, Massachusetts.
Dr. F. W. Marlow,	Syracuse, New York.
*Dr. W. V. Marmion,	Washington, D. C.
*Dr. W. B. Marple,	New York City.
*Dr. Arthur Mathewson,	Washington, D. C.
Dr. Chas. H. McIlwaine,	New York City.
Dr. John R. McIntosh,	St. John, New Brunswick.
*Dr. S. C. Maxson,†	Utica, New York.
Dr. C. H. May,†	New York City.
Dr. C. S. Merrill,	Albany, New York.
Dr. B. L. Millikin,	Cleveland, Ohio.
Dr. Horace Geo. Miller,	Providence, Rhode Island.
Dr. J. Lancelot Minor,	Memphis, Tennessee.
Dr. W. F. Mittendorf,	New York City.
*Dr. Charles A. Oliver,	Philadelphia, Pennsylvania.
Dr. H. S. Oppenheimer,	New York City.
*Dr. R. J. Phillips,	Philadelphia, Pennsylvania.
Dr. Thomas R. Pooley,	New York City.
*Dr. William C. Posey,	Philadelphia, Pennsylvania.
Dr. M. H. Post,	St. Louis, Missouri.
*Dr. H. R. Price,	Brooklyn, New York.
Dr. J. S. Prout,	Brooklyn, New York.
*Dr. Brown Pusey,†	Chicago, Illinois.
*Dr. Walter L. Pyle,	Philadelphia, Pennsylvania.
Dr. Alexander Quackenboss,	Boston, Massachusetts.
Dr. McCluny Radcliffe,†	Philadelphia, Pennsylvania.
*Dr. B. Alex'r Randall,	Philadelphia, Pennsylvania.
Dr. R. L. Randolph,	Baltimore, Maryland.
*Dr. J. M. Ray,	Louisville, Kentucky.
Dr. R. G. Reese,	New York City.
*Dr. R. A. Reeve,	Toronto, Canada.

*Dr. H. O. Reik,	Baltimore, Maryland.
Dr. Stephen O. Richey,	Washington, D. C.
Dr. Charles E. Rider,	Rochester, New York.
*Dr. Wheelock Rider,	Rochester, New York.
Dr. G. O. Ring,†	Philadelphia, Pennsylvania.
Dr. H. W. Ring,	New Haven, Connecticut.
*Dr. Samuel D. Risley,	Philadelphia, Pennsylvania.
Dr. Edmund C. Rivers,	Denver City, Colorado.
Dr. Wm. K. Rogers,	Columbus, Ohio.
Dr. B. St. John Roosa,	New York City.
Dr. Dunbar Roy,	Atlanta, Georgia.
Dr. John D. Rushmore,	Brooklyn, New York.
Dr. Robert Sattler,	Cincinnati, Ohio.
Dr. T. B. Schneideman,	Philadelphia, Pennsylvania.
*Dr. G. E. de Schweinitz,	Philadelphia, Pennsylvania.
*Dr. P. N. K. Schwenk,	Philadelphia, Pennsylvania.
*Dr. John R. Shannon,†	New York City.
Dr. Henry L. Shaw,	Boston, Massachusetts.
*Dr. H. G. Sherman,†	Cleveland, Ohio.
*Dr. Wm. T. Shoemaker,	Philadelphia, Pennsylvania.
*Dr. Wm. A. Shoemaker,	St. Louis, Missouri.
*Dr. E. A. Shumway,†	Philadelphia, Pennsylvania.
Dr. F. D. Skeel,	New York City.
*Dr. J. A. Spalding,	Portland, Maine.
*Dr. Myles Standish,	Boston, Massachusetts.
Dr. E. W. Stevens,	Denver, Colorado.
Dr. George T. Stevens,	New York City.
Dr. Edw. Stieren,	Pittsburg, Pennsylvania.
*Dr. Samuel B. St. John,	Hartford, Connecticut.
*Dr. Geo. Strawbridge,	Philadelphia, Pennsylvania.
*Dr. T. Y. Sutphen,	Newark, New Jersey.
*Dr. Wm. M. Sweet,	Philadelphia, Pennsylvania.
*Dr. Lewis H. Taylor,	Wilkesbarre, Pennsylvania.
*Dr. Samuel Theobald,	Baltimore, Maryland.
Dr. Ch. Hermon Thomas,	Philadelphia, Pennsylvania.
*Dr. A. G. Thomson,	Philadelphia, Pennsylvania.
Dr. Edgar S. Thomson,	New York City.
Dr. Jas. Thorington,	Philadelphia, Pennsylvania.
*Dr. H. H. Tyson,†	New York City.
*Dr. John VanDuyn,	Syracuse, New York.
*Dr. C. A. Veasey,	Philadelphia, Pennsylvania.
*Dr. F. H. Verhoeff,	Boston, Massachusetts.
Dr. O. F. Wadsworth,	Boston, Massachusetts.
Dr. F. L. Waite,	Hartford, Connecticut.
*Dr. David Webster,	New York City.
*Dr. J. E. Weeks.	New York City.
Dr. Cassius D. Westcott,†	Chicago, Illinois.
*Dr. J. A. White,	Richmond, Virginia.

Dr. W. H. Wilder,	Chicago, Illinois.
*Dr. Chas. H. Williams,	Boston, Massachusetts.
*Dr. Wm. H. Wilmer,	Washington, D. C.
*Dr. F. H. Wilson,	Bridgeport, Connecticut.
*Dr. J. Scott Wood,†	Brooklyn, New York.
Dr. William L. Wood,†	Portland, Oregon.
*Dr. Hiram Woods,	Baltimore, Maryland.
Dr. J. P. Worrell,	Terre Haute, Indiana.
*Dr. Wm. Zentmayer,†	Philadelphia, Pennsylvania.
*Dr. S. Lewis Ziegler,	Philadelphia, Pennsylvania.

† Associates.

HONORARY MEMBER.

Dr. F. P. Sprague,	Boston, Massachusetts.

AMERICAN OTOLOGICAL SOCIETY.

Organized 1866.

ACTIVE MEMBERS AND ASSOCIATES.

*Dr. A. E. Adams,	Newburg, New York.
*Dr. John L. Adams,	New York City.
*Dr. H. A. Alderton,	Brooklyn, New York.
Dr. A. Alt,	St. Louis, Missouri.
Dr. Emil Amberg,†	Detroit, Michigan.
*Dr. J. A. Andrews.	Santa Barbara, California.
*Dr. S. C. Ayres,	Cincinnati, Ohio.
*Dr. Gorham Bacon,	New York City.
Dr. Robert Barclay,	St. Louis, Missouri.
Dr. J. F. Barnhill,†	Indianapolis, Indiana.
Dr. Edwin W. Bartlett,	Milwaukee, Wisconsin.
Dr. T. P. Berens,	New York City.
*Dr. Clarence J. Blake,	Boston, Massachusetts.
*Dr. F. J. Blodgett,†	New York City.
Dr. R. O. Born,	New York City.
Dr. W. C. Braislin,†	Brooklyn, New York.
*Dr. J. H. Bryan,†	Washington, D. C.
*Dr. W. S. Bryant,	New York City.
*Dr. Earnest Buckman,†	Wilkesbarre, Pennsylvania.
Dr. Franklin P. Capron,	Providence, Rhode Island.
*Dr. W. H. Carmalt,	New Haven, Connecticut.
Dr. J. H. Clairborne, Jr.,	New York City.
*Dr. C. F. Clark.†	Columbus, Ohio.
Dr. J. B. Clemens,†	New York City.
*Dr. C. G. Coakley,†	New York City.
Dr. Wm. Cowen,	New York City.
Dr. Chas. N. Cox,	Brooklyn, New York.

*Dr. E. A. Crockett,	Boston, Massachusetts.
*Dr. J. Frank Crouch,†	Baltimore, Maryland.
Dr. J. P. Davidson,†	Richmond, Virginia.
Dr. Ewing W. Day,†	Pittsburg, Pennsylvania.
*Dr. Edw. B. Dench,	New York City.
Dr. E. E. Doble,	Quincy, Massachusetts.
*Dr. A. B. Duel,†	New York City.
*Dr. Wells P. Eagleton,	Newark, New Jersey.
Dr. J. B. Emerson,	New York City.
*Dr. George F. Fiske,	Chicago, Illinois.
Dr. Percy Fridenberg,	New York City.
*Dr. Harry Friedenwald,†	Baltimore, Maryland.
Dr. B. E. Fryer, U. S. A.,	Kansas City, Missouri.
Dr. J. Orne Green,	Boston, Massachusetts.
*Dr. Emil Gruening,	New York City.
*Dr. G. W. Hale,	Nashville, Tennessee.
Dr. Thos. H. Halstead,	Syracuse, New York.
Dr. Philip Hammond,	Boston, Massachusetts.
Dr. Geo. C. Harlan,	Philadelphia, Pennsylvania.
*Dr. Herbert Harlan,†	Baltimore, Maryland.
Dr. Thomas J. Harris,	New York City.
Dr. David Harrower, Jr.,	Worcester, Massachusetts.
Dr. W. H. Haskins,†	New York City.
Dr. N. Darrell Harvey,	Providence, Rhode Island.
*Dr. Neil J. Hepburn,	New York City.
*Dr. C. R. Holmes,†	Cincinnati, Ohio.
Dr. E. E. Holt,	Portland, Maine.
*Dr. Lucien Howe,	Buffalo, New York.
*Dr. Frederick L. Jack,	Boston, Massachusetts.
*Dr. W. B. Johnson,	Paterson, New Jersey.
*Dr. Richard Jordan,†	New York City.
*Dr. Joseph A. Kenefick,†	New York City.
Dr. B. R. Kennon,†	Norfolk, Virginia.
*Dr. Gordon King,†	New Orleans, Louisiana.
*Dr. Chas. J. Kipp,	Newark, New Jersey.
*Dr. Arnold Knapp,†	New York City.
Dr. Herman Knapp,	New York City.
Dr. Carl Koller,†	New York City.
*Dr. J. Braden Kyle,†	Philadelphia, Pennsylvania.
*Dr. G. A. Leland,	Boston, Massachusetts.
*Dr. John C. Lester,	Brooklyn, New York.
*Dr. Rob. Lewis, Jr.,	New York City.
*Dr. William Lincoln,†	Cleveland, Ohio.
Dr. J. A. Lippincott,	Pittsburg, Pennsylvania.
Dr. James E. Logan,†	Kansas City, Missouri.
*Dr. F. B. Loring,	Washington, D. C.
Dr. David B. Lovell,	Worcester, Massachusetts.
Dr. Chas. H. May,	New York City.

Dr. G. B. McAuliffe,	New York City.
Dr. Read J. McKay,	Wilmington, Delaware.
*Dr. J. F. McKernon,	New York City.
Dr. C. S. Merrill,	Albany, New York.
Dr. H. L. Morse,	Boston, Massachusetts.
Dr. W. B. Moulton,†	Portland, Maine.
*Dr. Robert C. Myles,	New York City.
*Dr. F. R. Packard,†	Philadelphia, Pennsylvania.
Dr. Wendell C. Phillips,	New York City.
*Dr. Norval H. Pierce,†	Chicago, Illinois.
Dr. E. M. Plummer,†	Charlestown, Massachusetts.
Dr. Thomas R. Pooley,	New York City.
*Dr. Barton H. Potts,†	Philadelphia, Pennsylvania.
*Dr. B. Alex. Randall,	Philadelphia, Pennsylvania.
Dr. R. L. Randolph,†	Baltimore, Maryland.
*Dr. J. M. Ray,	Louisville, Kentucky.
Dr. R. G. Reese,†	New York City.
*Dr. R. A. Reeve,	Toronto, Canada.
*Dr. H. O. Reik,	Baltimore, Maryland.
*Dr. J. Scott Renner,†	Buffalo, New York.
*Dr. Geo. L. Richards,	Fall River, Massachusetts.
Dr. Huntington Richards,	Concord, New Hampshire.
*Dr. Chas. W. Richardson,	Washington, D. C.
*Dr. S. O. Richey,	Washington, D. C.
Dr. Charles E. Rider,	Rochester, New York.
Dr. Wheelock Rider,	Rochester, New York.
Dr. H. W. Ring,	New Haven, Connecticut.
*Dr. S. D. Risley,	Philadelphia, Pennsylvania.
Dr. Edmund C. Rivers,†	Denver, Colorado.
*Dr. A. W. deRoaldes,	New Orleans, Louisiana.
Dr. William King Rogers,†	Columbus, Ohio.
Dr. D. B. St. John Roosa,	New York City.
Dr. John D. Rushmore,	Brooklyn, New York.
Dr. Ralph W. Seiss,	Philadelphia, Pennsylvania.
*Dr. Geo. E. Shambaugh,†	Chicago, Illinois.
Dr. J. B. Shapleigh,	St. Louis, Missouri.
Dr. W. S. Shattuck, Jr.†	Brooklyn, New York.
Dr. Henry L. Shaw,	Boston, Massachusetts.
*Dr. J. E. Sheppard,	Brooklyn, New York.
*Dr. E. Terry Smith,†	Hartford, Connecticut.
*Dr. Sargent F. Snow,†	Syracuse, New York.
Dr. E. D. Spear,	Boston, Massachusetts.
Dr. H. N. Spencer,	St. Louis, Missouri.
Dr. Frank B. Sprague,	Providence, Rhode Island.
Dr. George T. Stevens,	New York City.
*Dr. Franklin M. Stephens,†	New York City.
Dr. Edward Stieren,†	Pittsburg, Pennsylvania.
*Dr. S. B. St. John,	Hartford, Connecticut.

*Dr. Geo. Strawbridge,	Philadelphia, Pennsylvania.
*Dr. T. Y. Sutphen,	Newark, New Jersey.
*Dr. L. H. Taylor,	Wilkesbarre, Pennsylvania.
*Dr. Samuel Theobald,	Baltimore, Maryland.
*Dr. Andrew Timberman,†	Columbus, Ohio.
*Dr. J. VanDuyn,	Syracuse, New York.
Dr. E. Dewolf Wales,†	Indianapolis, Indiana.
Dr. H. Harold Walker,†	Boston, Massachusetts.
*Dr. David Webster,	New York City.
*Dr. J. A. White,†	Richmond, Virginia.
Dr. F. Whiting,	New York City.
*Dr. F. M. Wilson,	Bridgeport, Connecticut.
*Dr. Hiram Woods,	Baltimore, Maryland.

† Associates.

HONORARY MEMBERS.

Prof. A. Graham Bell,	Washington, D. C.
Dr. Albert H. Buck,	New York City.
Dr. John Green,	St. Louis, Missouri.
Mr. W. Macewen,	Glasgow, Scotland.
*Dr. Arthur Mathewson,	Washington, D. C.
Prof. Adam Politzer,	Vienna, Austria.
Prof. Ogden M. Rood,	New York City.
Dr. Luc,	Paris, France.

AMERICAN NEUROLOGICAL ASSOCIATION.

Organized, June, 1875.

ACTIVE MEMBERS.

*Dr. A. R. Allen,	Philadelphia, Pennsylvania.
*Dr. Edward B. Angell,	Rochester, New York.
Dr. Samuel Ayres,	Pittsburg, Pennsylvania.
*Dr. Pearce Bailey,	New York City.
Dr. Smith Baker,	Utica, New York.
*Dr. L. F. Barker,	Baltimore, Maryland.
*Dr. A. M. Barrett,	Danvers, Massachusetts.
Dr. E. D. Bondurant,	Mobile, Alabama.
*Dr. J. Arthur Booth,	New York City.
Dr. N. E. Brill,	New York City.
Dr. D. R. Brower,	Chicago, Illinois.
*Dr. Wm. Browning,	Brooklyn, New York.
*Dr. E. N. Brush,	Towson P. O., Maryland.
*Dr. W. N. Bullard,	Boston, Massachusetts.
*Dr. C. B. Burr,	Flint, Michigan.
*Dr. Charles W. Burr,	Philadelphia, Pennsylvania.
*Dr. Carl D. Camp,	Philadelphia, Pennsylvania.

Dr. Charles G. Chaddock,	St. Louis, Missouri.
Dr. Walter Channing,	Brookline, Massachusetts.
*Dr. L. P. Clark,	New York City.
Dr. Joseph Collins,	New York City.
Dr. Joseph W. Courtney,	Boston, Massachusetts.
Dr. Edward Cowles,	Boston, Massachusetts.
*Dr. Harvey Cushing,	Baltimore, Maryland.
*Dr. Charles L. Dana,	New York City.
*Dr. F. X. Dercum,	Philadelphia, Pennsylvania.
*Dr. Richard Dewey,	Wauwatosa, Wisconsin.
*Dr. A. R. Diefendorf,	Middletown, Connecticut.
*Dr. Theodore Diller,	Pittsburg, Pennsylvania.
*Dr. H. H. Donaldson,	Philadelphia, Pennsylvania.
*Dr. E. D. Fisher,	New York City.
Dr. Joseph Fraenkel,	New York City.
Dr. Charles H. Frazier,	Philadelphia, Pennsylvania.
*Dr. F. R. Fry,	St. Louis, Missouri.
*Dr. H. C. Gordinier,	Troy, New York.
*Dr. Alfred Gordon,	Philadelphia, Pennsylvania.
*Dr. Frank R. Hallcock,	Cromwell, Connecticut.
Dr. A. McL. Hamilton,	New York City.
*Dr. Graeme M. Hammond,	New York City.
*Dr. Guy Hinsdale,	Hot Springs, Virginia.
Dr. William Hirsch,	New York City.
*Dr. A. Hoch,	White Plains, New York.
*Dr. H. H. Hoppe,	Cincinnati, Ohio.
*Dr. Henry Hun,	Albany, New York.
*Dr. J. R. Hunt,	New York City.
*Dr. George W. Jacoby,	New York City.
*Dr. Smith E. Jelliffe,	New York City.
Dr. Theodore H. Kellogg,	Riverdale, New York.
*Dr. Philip C. Knapp,	Boston, Massachusetts.
*Dr. William C. Krauss,	Buffalo, New York.
Dr. Sidney Kuh,	Chicago, Illinois.
Dr. Edward B. Lane,	New Dorchester, Massachusetts.
*Dr. F. W. Langdon,	Cincinnati, Ohio.
Dr. Wm. M. Leszynsky,	New York City.
Dr. S. B. Lyon,	White Plains, New York.
Dr. James H. McBride,	Pasadena, California.
*Dr. Daniel J. McCarthy,	Philadelphia, Pennsylvania.
*Dr. J. W. McConnell,	Philadelphia, Pennsylvania.
*Dr. T. M. T. McKennan,	Pittsburg, Pennsylvania.
*Dr. Adolf Meyer,	Ward's Island, New York.
*Dr. Charles K. Mills,	Philadelphia, Pennsylvania.
*Dr. J. K. Mitchell,	Philadelphia, Pennsylvania.
*Dr. William J. Morton,	New York City.
*Dr. J. M. Mosher,	Albany, New York.
*Dr. Harold N. Moyer,	Chicago, Illinois.

Dr. Leo Newmark,	San Francisco, California.
*Dr. William Noyes,	Mattapan, Massachusetts.
*Dr. B. Onuf,	New York City.
*Dr. Isaac Ott,	Easton, Pennsylvania.
Dr. Stewart Paton,	Baltimore, Maryland.
*Dr. Hugh T. Patrick,	Chicago, Illinois.
*Dr. W. E. Paul,	Boston, Massachusetts.
Dr. Howell T. Pershing,	Denver, Colorado.
Dr. Frederick Peterson,	New York City.
Dr. William Pickett,	Philadelphia, Pennsylvania.
*Dr. Charles S. Potts,	Philadelphia, Pennsylvania.
Dr. G. J. Preston,	Baltimore, Maryland.
*Dr. Morton Prince,	Boston, Massachusetts.
Dr. John Punton,	Kansas City, Missouri.
*Dr. J. J. Putnam,	Boston, Massachusetts.
*Dr. J. W. Putnam,	Buffalo, New York.
Dr. J. H. Rhein,	Philadelphia, Pennsylvania.
*Dr. C. Eugene Riggs,	St. Paul, Minnesota.
*Dr. B. Sachs,	New York City.
*Dr. Joseph Sailer,	Philadelphia, Pennsylvania.
*Dr. Sidney J. Schwab,	St. Louis, Missouri.
*Dr. David A. Shirres,	Montreal, Canada.
Dr. Wharton Sinkler,	Philadelphia, Pennsylvania.
*Dr. William G. Spiller,	Philadelphia, Pennsylvania.
Dr. E. C. Spitzka,	New York City.
Dr. William G. Spratling,	Sonyea, New York.
*Dr. M. A. Starr,	New York City.
*Dr. Henry R. Stedman,	Brookline, Massachusetts.
Dr. E. E. Southard,	Boston, Massachusetts.
Dr. Edward W. Taylor,	Boston, Massachusetts.
*Dr. H. M. Thomas,	Baltimore, Maryland.
*Dr. John Jenks Thomas,	Boston, Massachusetts.
Dr. H. A. Tomlinson,	St. Peter, Minnesota.
Dr. Henry Upson,	Cleveland, Ohio.
*Dr. W. K. Walker,	Dixmount, Pennsylvania.
*Dr. George L. Walton,	Boston, Massachusetts.
Dr. G. A. Waterman,	Boston, Massachusetts.
*Dr. F. H. Weisenberg,	Philadelphia, Pennsylvania.
Dr. A. Wiener,	New York City.
Dr. Burt G. Wilder,	Ithaca, New York.
Dr. David J. Wolfstein,	Cincinnati, Ohio.
*Dr. Philip Zenner,	Cincinnati, Ohio.

ASSOCIATE MEMBERS.

H. M. Bannister,	Evanston, Illinois.
H. Charlton Bastian, Esq.,	London, England.
M. Bernhardt,	Berlin, Germany.
Ramon Y. Cajal,	Madrid, Spain.

S. F. Daniello,	St. Petersburg, Russia.
J. Dejerine,	Paris, France.
Thomas S. Dowse, Esq.,	London, England.
Ludwig Edinger,	Frankfurt-Am-Main, Germany.
Dr. N. B. Emerson,	Honolulu, Sandwich Islands.
Auguste Forel,	Zurich, Switzerland.
Henri Huchard,	Paris, France.
James H. Lloyd,	Philadelphia, Pennsylvania.
J. S. Lombard,	Upper Norwood, England.
Dr. J. J. Mason,	Newport, Rhode Island.
H. Mieriewski,	St. Petersburg, Russia.
Prof. Dr. H. Obersteiner,	Vienna, Austria.
Auguste Olliviera,	Paris, France.
Ralph L. Parsons,	Greenmont-on-Hudson, New York.
Prof. Dr. Arnold Pick,	Prague, Austria.
S. G. Webber,	Boston, Massachusetts.

HONORARY MEMBERS.

Byron Bramwell,	Edinburgh, Scotland.
Dr. Robert T. Edes,	Reading, Massachusetts.
Prof. David Erb,	Leipzig, Germany.
David Ferrier,	London, England.
C. Golgi,	Pavia, Italy.
Sir William R. Gowers,	London, England.
Victor A. H. Horsley, F.R.C.S.,	London, England.
J. Hughlings Jackson, Esq.,	London, England.
*Dr. S. Weir Mitchell,	Philadelphia, Pennsylvania.
Dr. H. Nothnagel,	Vienna, Austria.
Dr. William Osler,	Oxford, England.

AMERICAN GYNECOLOGICAL SOCIETY.

Organized, June, 1876.

ACTIVE FELLOWS.

*Dr. Frank T. Andrews,	Chicago, Illinois.
*Dr. T. A. Ashby,	Baltimore, Maryland.
*Dr. W. E. Ashton,	Philadelphia, Pennsylvania.
*Dr. B. F. Baer,	Philadelphia, Pennsylvania.
*Dr. W. H. Baker,	Boston, Massachusetts.
*Dr. J. M. Baldy,	Philadelphia, Pennsylvania.
*Dr. Eugene Boise,	Grand Rapids, Michigan.
*Dr. H. J. Boldt,	New York City.
*Dr. J. Wesley Bovée,	Washington, D. C.
*Dr. LeRoy Broun,	New York City.
*Dr. B. B. Browne,	Baltimore, Maryland.
Dr. A. H. Buckmaster,	Charlottesville, Virginia.
Dr. W. L. Burrage,	Boston, Massachusetts.

*Dr. H. T. Byford,	Chicago, Illinois.
*Dr. W. W. Chipman,	Montreal, Canada.
*Dr. John G. Clark,	Philadelphia, Pennsylvania.
*Dr. Clement Cleveland,	New York City.
*Dr. H. C. Coe,	New York City.
*Dr. E. B. Cragin,	New York City.
*Dr. T. S. Cullen,	Baltimore, Maryland.
Dr. A. F. Currier,	Mt. Vernon, New York.
*Dr. E. W. Cushing,	Boston, Massachusetts.
*Dr. Francis H. Davenport,	Boston, Massachusetts.
*Dr. E. P. Davis,	Philadelphia, Pennsylvania.
*Dr. R. L. Dickinson,	Brooklyn, New York.
*Dr. Emilius C. Dudley,	Chicago, Illinois.
*Dr. Edward L. Duer,	Philadelphia, Pennsylvania.
*Dr. George M. Edebohls,	New York City.
Dr. James C. Edgar,	New York City.
Dr. Hugo Ehrenfest,	St. Louis, Missouri.
*Dr. Bache McE. Emmet,	New York City.
Dr. John D. Emmet,	New York City.
Dr. Palmer Findley,	Omaha, Nebraska.
*Dr. Willis E. Ford,	Utica, New York.
*Dr. Carlton C. Frederick,	Buffalo, New York.
*Dr. Henry D. Fry,	Washington, D. C.
Dr. Eugene Gehrung,	St. Louis, Missouri.
*Dr. George Gellhorn,	St. Louis, Missouri.
*Dr. J. Riddle Goffe,	New York City.
*Dr. Seth Gordon,	Portland, Maine.
*Dr. Egbert H. Grandin,	New York City.
*Dr. Charles M. Green,	Boston, Massachusetts.
*Dr. Philander A. Harris,	Paterson, New Jersey.
Dr. George T. Harrison,	New York City.
Dr. Barton C. Hirst,	Philadelphia, Pennsylvania.
Dr. Phineas Ingalls,	Hartford, Connecticut.
*Dr. J. E. Janvrin,	New York City.
*Dr. George W. Jarman,	New York City.
*Dr. Charles Jewett,	Brooklyn, New York.
*Dr. J. Taber Johnson,	Washington, D. C.
*Dr. Howard A. Kelley,	Baltimore, Maryland.
*Dr. A. F. A. King,	Washington, D. C.
*Dr. Cyrus A. Kirkley,	Toledo, Ohio.
Dr. Florian Krug,	New York City.
*Dr. Beverly MacMonagle,	San Francisco, California.
Dr. Matthew D. Mann,	Buffalo, New York.
*Dr. W. P. Manton,	Detroit, Michigan.
Dr. Richard B. Maury,	Memphis, Tennessee.
*Dr. Malcolm McLean,	New York City.
*Dr. E. E. Montgomery,	Philadelphia, Pennsylvania.
*Dr. William E. Moseley,	Baltimore, Maryland.

*Dr. Robert A. Murray,	New York City.
*Dr. Franklin S. Newell,	Boston, Massachusetts.
*Dr. Henry P. Newman,	Chicago, Illinois.
*Dr. Charles P. Noble,	Philadelphia, Pennsylvania.
Dr. George H. Noble,	Atlanta, Georgia.
Dr. Richard C. Norris,	Philadelphia, Pennsylvania.
*Dr. Charles B. Penrose,	Philadelphia, Pennsylvania.
*Dr. Reuben Peterson,	Ann Arbor, Michigan.
*Dr William M. Polk,	New York City.
*Dr. Edward Reynolds,	Boston, Massachusetts.
*Dr. Hunter Robb,	Cleveland, Ohio.
*Dr. Frank F. Simpson,	Pittsburg, Pennsylvania.
*Dr. A. Lapthorn Smith,	Montreal, Canada.
*Dr. Richard R. Smith,	Grand Rapids, Michigan.
*Dr. Isaac S. Stone,	Washington, D. C.
*Dr. Frederick J. Taussig,	St. Louis, Missouri.
*Dr. Howard C. Taylor,	New York City.
*Dr. John F. Thompson,	Portland, Maine.
Dr. Ely Van de Warker,	Syracuse, New York.
*Dr. Hiram Vineburg,	New York City.
*Dr. W. Francis B. Wakefield,	San Francisco, California.
*Dr. William H. Wathen,	Louisville, Kentucky.
*Dr. Thomas J. Watkins,	Chicago, Illinois.
*Dr. John C. Webster,	Chicago, Illinois.
*Dr. Brooks H. Wells,	New York City.
*Dr. J. Whitridge Williams,	Baltimore, Maryland.
*Dr. W. Gill Wylie,	New York City.

HONORARY FELLOWS.

Dr. George G. Bantock,	London, England.
Dr. Robert Barnes,	Eastbourne, England.
Dr. John S. Billings,	New York City.
Dr. Chas. J. Cullingworth,	London, England.
Dr. J. Amédée Doléris,	Paris, France.
Dr. Thomas A. Emmet,	New York City.
*Dr. William Gardner,	Montreal, Canada.
*Dr. Henry J. Garrigues,	New York City.
Dr. D. Berry Hart,	Edinburgh, Scotland.
Dr. Charles Jacobs,	Brussels, Belgium.
Dr. Christian G. Leopold,	Dresden, Germany.
Prof. August Martin,	Greifswald, Germany.
Dr. Ottavio Morisani,	Naples, Italy.
Dr. Robert Ohlshausen,	Berlin, Germany.
*Dr. Chauncey Palmer,	Cincinnati, Ohio.
Dr. K. Pawlik,	Prague, Austria.
Dr. Samuel Pozzi,	Paris, France.
Dr. T. A. Reamy,	Cincinnati, Ohio.
Dr. J. C. Reeve,	Dayton, Ohio.

Dr. William L. Richardson,	Boston, Massachusetts.
Dr. Paul Segond,	Paris, France.
Prof. Alexander Simpson,	Edinburgh, Scotland.
Dr. Thomas Tuffier,	Paris, France.
Prof. Dr. F. von Winckel,	Munich, Germany.

AMERICAN DERMATOLOGICAL ASSOCIATION.*

Organized, September, 1876.

ACTIVE MEMBERS.

Dr. Henry G. Anthony,	Chicago, Illinois.
Dr. Andrew P. Biddle,	Detroit, Michigan.
Dr. John T. Bowen,	Boston, Massachusetts.
Dr. William F. Breakey,	Ann Arbor, Michigan.
Dr. Edward B. Bronson,	New York City.
Dr. Lucius D. Bulkley,	New York City.
Dr. Ralph R. Campbell,	Chicago, Illinois.
Dr. Randolph B. Carmichael,	Washington, D. C.
Dr. William T. Corlett,	Cleveland, Ohio.
Dr. Louis A. Duhring,	Philadelphia, Pennsylvania.
Dr. Isadore Dyer,	New Orleans, Louisiana.
Dr. George T. Elliot,	New York City.
Dr. Martin F. Engman,	St. Louis, Missouri.
*Dr. John A. Fordyce,	New York City.
Dr. Burnside Foster,	St. Paul, Minnesota.
Dr. George H. Fox,	New York City.
Dr. Thomas C. Gilchrist,	Baltimore, Maryland.
Dr. Herman Goldenberg,	New York City.
Dr. Joseph Grindon,	St. Louis, Missouri.
Dr. William Hardaway,	St. Louis, Missouri.
Dr. George F. Harding,	Boston, Massachusetts.
Dr. Milton B. Hartzell,	Philadelphia, Pennsylvania.
Dr. Oscar H. Holder,	New York City.
Dr. James S. Howe,	Boston, Massachusetts.
*Dr. James N. Hyde,	Chicago, Illinois.
*Dr. George T. Jackson,	New York City.
Dr. James C. Johnston,	New York City.
Dr. Hermann G. Klotz,	New York City.
Dr. Frederick J. Leviseur,	New York City.
Dr. Sigmund Lustgarten,	New York City.
Dr. Ala D. Mewborn,	New York City.
Dr. Douglass W. Montgomery,	San Francisco, California.
*Dr. Frank H. Montgomery,	Chicago, Illinois.
Dr. Howard Morrow,	San Francisco, California.

*Owing to the International Dermatological Association meeting in the United States this year, the A. D. A. decided to postpone its annual meeting.

Dr. Prince A. Morrow,	New York City.
Dr. Lucius C. Pardee,	Chicago, Illinois.
Dr. Sigmund Pollitzer,	New York City.
Dr. Abner Post,	Boston, Massachusetts.
Dr. William A. Pusey,	Chicago, Illinois.
Dr. Augustus Ravogli,	Cincinnati, Ohio.
Dr. Andrew R. Robinson,	New York City.
Dr. E. Wood Ruggles,	Rochester, New York.
Dr. Alfred Schalek,	Chicago, Illinois.
Dr. Jay F. Schamberg,	Philadelphia, Pennsylvania.
*Dr. Francis J. Shepherd,	Montreal, Canada.
Dr. Samuel Sherwell,	Brooklyn, New York.
*Dr. Henry W. Stelwagon,	Philadelphia, Pennsylvania.
Dr. Robert W. Taylor,	New York City.
Dr. Harry P. Towles,	Boston, Massachusetts.
Dr. Arthur Van Harlingen,	Philadelphia, Pennsylvania.
Dr. Ernest Wende,	Buffalo, New York.
Dr. Grover W. Wende,	Buffalo, New York.
Dr. Charles J. White,	Boston, Massachusetts.
Dr. James C. White,	Boston, Massachusetts.
Dr. Henry H. Whitehouse,	New York City.
Dr. James MacF. Winfield,	Brooklyn, New York.
Dr. Joseph Zeisler,	Chicago, Illinois.

HONORARY MEMBERS.

Dr. T. McCall Anderson, Esq.,	Glasgow, Scotland.
Mr. E. Besnier,	Paris, France.
Prof. Dr. Cäsar Boeck,	Christiania, Norway.
Dr. H. Radcliffe-Crocker,	London, England.
Prof. Dr. Thommaso De Amicis,	Naples, Italy.
Mr. Jonathan Hutchinson,	London, England.
Prof. Dr. Edmund Lesser,	Berlin, Germany.
Prof. Dr. A. Neisser,	Breslau, Germany.
Prof. Dr. I. Neumann,	Vienna, Austria.
Prof. Dr. F. J. Pick,	Prague, Austria.

AMERICAN LARYNGOLOGICAL ASSOCIATION.

Organized, June, 1878.

ACTIVE FELLOWS.

*Dr. William L. Ballenger,	Chicago, Illinois.
Dr. C. E. Bean,	St. Paul, Minnesota.
Dr. T. Passmore Berens,	New York City.
*Dr. Herbert S. Birkett,	Montreal, Canada.
*Dr. Arthur Ames Bliss,	Philadelphia, Pennsylvania.
*Dr. Francke H. Bosworth,	New York City.

Dr. J. Price-Brown,	Toronto, Canada.
Dr. Moreau R. Brown,	Chicago, Illinois.
*Dr. Joseph H. Bryan,	Washington, D. C.
*Dr. William E. Casselberry,	Chicago, Illinois.
*Dr. Walter F. Chappell,	New York City.
*Dr. J. Payson Clark,	Boston, Massachusetts.
*Dr. Cornelius G. Coakley,	New York City.
*Dr. Frederic C. Cobb,	Boston, Massachusetts.
*Dr. Lewis A. Coffin,	New York City.
*Dr. J. Solis-Cohen,	Philadelphia, Pennsylvania.
*Dr. Algernon Coolidge, Jr.	Boston, Massachusetts.
Dr. Thomas Amory DeBlois,	Boston, Massachusetts.
*Dr. D. Bryson Delavan,	New York City.
*Dr. John W. Farlow,	Boston, Massachusetts.
*Dr. Walter J. Freeman,	Philadelphia, Pennsylvania.
Dr. Otto T. Freer,	Chicago, Illinois.
Dr. Thomas R. French,	Brooklyn, New York.
*Dr. Richard Frothingham,	New York City.
*Dr. Joseph S. Gibb,	Philadelphia, Pennsylvania.
*Dr. Joseph W. Gleitsmann,	New York City.
*Dr. Joseph L. Goodale,	Boston, Massachusetts.
Dr. Charles P. Grayson,	Philadelphia, Pennsylvania.
*Dr. D. Crosby Greene, Jr.,	Boston, Massachusetts.
Dr. Thomas H. Halsted,	Syracuse, New York.
*Dr. T. Melville Hardie,	Chicago, Illinois.
Dr. Thomas J. Harris,	New York City.
*Dr. Jacob H. Hartman,	Baltimore, Maryland.
Dr. F. Whitehill Hinkel,	Buffalo, New York.
Dr. Urban G. Hitchcock,	New York City.
*Dr. Christian R. Holmes,	Cincinnati, Ohio.
Dr. George B. Hope,	New York City.
*Dr. Frederic E. Hopkins,	Springfield, Massachusetts.
*Dr. Thomas Hubbard,	Toledo, Ohio.
*Dr. Franck Hyatt,	Washington, D. C.
*Dr. E. Fletcher Ingals,	Chicago, Illinois.
*Dr. John M. Ingersoll,	Cleveland, Ohio.
Dr. Frank L. Ives,	New York City.
*Dr. Chevalier Jackson,	Pittsburg, Pennsylvania.
*Dr. Samuel Johnston,	Baltimore, Maryland.
*Dr. Gordon King,	New Orleans, Louisiana.
Dr. Charles H. Knight,	New York City.
*Dr. Frederick I. Knight,	Boston, Massachusetts.
*Dr. D. Braden Kyle,	Philadelphia, Pennsylvania.
*Dr. Samuel W. Langmaid,	Boston, Massachusetts.
Dr. George Morewood Lefferts,	New York City.
*Dr. George A. Leland,	Boston, Massachusetts.
*Dr. William Lincoln,	Cleveland, Ohio.
Dr. James E. Logan,	Kansas City, Missouri.

*Dr. John H. Lowman,	Cleveland, Ohio.
Dr. Alexander W. MacCoy,	Philadelphia, Pennsylvania.
*Dr. John N. Mackenzie,	Baltimore, Maryland.
*Dr. G. Hudson Makuen,	Philadelphia, Pennsylvania.
*Dr. Emil Mayer,	New York City.
*Dr. James F. McKernon,	New York City.
*Dr. Harris P. Mosher,	Boston, Massachusetts.
*Dr. Robert C. Myles,	New York City.
*Dr. James E. Newcomb,	New York City.
*Dr. Francis R. Packard,	Philadelphia, Pennsylvania.
*Dr. Norval H. Pierce,	Chicago, Illinois.
Dr. W. Peyre Porcher,	Charleston, South Carolina.
Dr. William Porter,	St. Louis, Missouri.
*Dr. W. Scott Renner,	Buffalo, New York.
*Dr. J. Edwin Rhodes,	Chicago, Illinois.
*Dr. Clarence C. Rice,	New York City.
*Dr. George L. Richards,	Fall River, Massachusetts.
*Dr. Charles W. Richardson,	Washington, D. C.
*Dr. Arthur W. de Roaldes,	New Orleans, Louisiana.
*Dr. John O. Roe,	Rochester, New York.
*Dr. George E. Shambaugh,	Chicago, Illinois.
*Dr. Ernest L. Shurly,	Detroit, Michigan.
*Dr. William K. Simpson,	New York City.
*Dr. Henry L. Swain,	New Haven, Connecticut.
Dr. Clement F. Theisen,	Albany, New York.
Dr. Allen B. Thrasher,	Cincinnati, Ohio.
Dr. Henry L. Wagner,	New York City.
*Dr. Arthur W. Watson,	San Francisco, California.
*Dr. John R. Winslow,	Philadelphia, Pennsylvania.
Dr. George B. Wood,	Baltimore, Maryland.
Dr. Jonathan Wright,	Philadelphia, Pennsylvania.

HONORARY FELLOW.

Dr. Leopold von Schroetter,	Vienna, Austria.

CORRESPONDING FELLOWS.

Prof. Paul Bruns,	Würtemberg, Germany.
Dr. Ottokar Chiari,	Vienna, Austria.
Dr. Mayo Collier,	London, England.
Dr. R. De La Sota y Lastra,	Seville, Spain.
Dr. C. M. Desvernine,	Havana, Cuba.
Dr. B. Fraenkel,	Berlin, Germany.
Dr. Dundas Grant,	London, England.
Dr. Paul Heymann,	Berlin, Germany.
Dr. E. Holden,	Newark, New Jersey.
Dr. H. Krause,	Berlin, Germany.
Dr. Carlo Labus,	Milan, Italy.

Dr. Marcel Lermoyez,	Paris, France.
Dr. H. Luc,	Paris, France.
Dr. P. McBride,	Edinburgh, Scotland.
Dr. Greville Macdonald,	London, England.
Dr. John Macintyre,	Glasgow, Scotland.
Dr. F. Massei,	Naples, Italy.
Dr. E. J. Moure,	Bordeaux, France.
Dr. Holger Mygind,	Copenhagen, Denmark.
Dr. Marcel Natier,	Paris, France.
Dr. A. Onodi,	Buda-Pesth, Hungary.
Dr. C. E. Sajous,	Philadelphia, Pennsylvania.
Dr. Moritz Schmidt,	Frankfurt, Germany.
Dr. Ernest Schmiegelow,	Copenhagen, Denmark.
Sir Felix Semon,	London, England.
Dr. St. Clair Thomson,	London, England.
Dr. Herbert Tilley,	London, England.
Dr. Wyatt Wingrave,	London, England.
Dr. R. Norris Wolfenden,	Sussex, England.

AMERICAN SURGICAL ASSOCIATION.

Organized, June, 1880.

ACTIVE FELLOWS.

*Dr. Robert Abbe,	New York City.
*Dr. D. P. Allen,	Cleveland, Ohio.
*Dr. E. Wyllys Andrews,	Chicago, Illinois.
Dr. George E. Armstrong,	Montreal, Canada.
*Dr. David Barrow,	Lexington, Kentucky.
*Dr. James Bell,	Montreal, Canada.
*Dr. Arthur D. Bevan,	Chicago, Illinois.
*Dr. John F. Binnie,	Kansas City, Missouri.
*Dr. John B. Blake,	Boston, Massachusetts.
*Dr. Joseph A. Blake,	New York City.
*Dr. Joseph C. Bloodgood,	Baltimore, Maryland.
*Dr. L. C. Bosher,	Richmond, Virginia.
*Dr. E. H. Bradford,	Boston, Massachusetts.
*Dr. George E. Brewer,	New York City.
*Dr. A. T. Bristow,	Brooklyn, New York.
*Dr. J. D. Bryant,	New York City.
Dr. William T. Bull,	New York City.
*Dr. Frank E. Bunts,	Cleveland, Ohio.
*Dr. H. L. Burrell,	Boston, Massachusetts.
*Dr. Arthur T. Cabot,	Boston, Massachusetts.
*Dr. N. B. Carson,	St. Louis, Missouri.
*Dr. C. K. Cole,	New York City.
*Dr. William B. Coley,	New York City.
*Dr. George W. Crile,	Cleveland, Ohio.

*Dr. B. F. Curtis,	New York City.
*Dr. Harvey Cushing,	Baltimore, Maryland.
*Dr. Haywood W. Cushing,	Boston, Massachusetts.
*Dr. J. Chalmers DaCosta,	Philadelphia, Pennsylvania.
*Dr. N. P. Dandridge,	Cincinnati, Ohio.
*Dr. John B. Deaver,	Philadelphia, Pennsylvania.
*Dr. F. S. Dennis,	New York City.
*Dr. Ellsworth Eliot, Jr.,	New York City.
Dr. J. W. Elliot,	Boston, Massachusetts.
*Dr. W. L. Estes,	South Bethlehem, Pennsylvania.
Dr. Duncan Eve,	Nashville, Tennessee.
*Dr. Alexander H. Ferguson,	Chicago, Illinois.
*Dr. J. M. T. Finney,	Baltimore, Maryland.
*Dr. Charles H. Frazier,	Philadelphia, Pennsylvania.
*Dr. Leonard Freeman,	Denver, Colorado.
*Dr. Frederic H. Gerrish,	Portland, Maine.
*Dr. A. G. Gerster,	New York City.
*Dr. John H. Gibbon,	Philadelphia, Pennsylvania.
*Dr. Charles L. Gibson,	New York City.
Dr. Carl A. Hamann,	Cleveland, Ohio.
*Dr. F. B. Harrington,	Boston, Massachusetts.
*Dr. Malcolm L. Harris,	Chicago, Illinois.
*Dr. Richard H. Harte,	Philadelphia, Pennsylvania.
Dr. W. Joseph Hearn,	Philadelphia, Pennsylvania.
*Dr. Orville Horwitz,	Philadelphia, Pennsylvania.
*Dr. T. W. Huntington,	San Francisco, California.
Dr. James P. Hutchinson,	Philadelphia, Pennsylvania.
*Dr. Nathan Jacobson,	Syracuse, New York.
Dr. Alexander B. Johnson,	New York City.
*Dr. Robert W. Johnson,	Baltimore, Maryland.
*Dr. George Ben Johnston,	Richmond, Virginia.
Dr. August F. Jonas,	Omaha, Nebraska.
Dr. Frederick Kammerer,	New York City.
*Dr. Robert D. LeConte,	Philadelphia, Pennsylvania.
*Dr. Frank J. Lutz,	St. Louis, Missouri.
*Dr. Willis G. Macdonald,	Albany, New York.
*Dr. A. MacLaren,	St. Paul, Minnesota.
*Dr. Beverly MacMonagle,	San Francisco, California.
Dr. Francis H. Markoe,	New York City.
*Dr. Edward Martin,	Philadelphia, Pennsylvania.
Dr. Rudolph Matas,	New Orleans, Louisiana.
*Dr. Charles H. Mayo,	Rochester, Minnesota.
*Dr. William J. Mayo,	Rochester, Minnesota.
Dr. Lewis L. McArthur,	Chicago, Illinois.
*Dr. Andrew J. McCosh,	New York City.
Dr. T. A. McGraw,	Detroit, Michigan.
*Dr. Lewis S. McMurtry,	Louisville, Kentucky.

*Dr. Willy Meyer,	New York City.
*Dr. Samuel J. Mixter,	Boston, Massachusetts.
*Dr. George H. Monks,	Boston, Massachusetts.
*Dr. James E. Moore,	Minneapolis, Minnesota.
Dr. Thomas S. K. Morton,	Philadelphia, Pennsylvania.
*Dr. Harvey G. Mudd,	St. Louis, Missouri.
*Dr. James G. Mumford,	Boston, Massachusetts.
*Dr. John C. Munro,	Boston, Massachusetts.
*Dr. John B. Murphy,	Chicago, Illinois.
Dr. Francis W. Murray,	New York City.
*Dr. C. B. G. de Nancrède,	Ann Arbor, Michigan.
*Dr. Thomas R. Neilson,	Philadelphia, Pennsylvania.
*Dr. Albert J. Ochsner,	Chicago, Illinois.
*Dr. John C. Oliver,	Cincinnati, Ohio.
*Dr. Charles W. Oviatt,	Oshkosh, Wisconsin.
Dr. F. W. Parham,	New Orleans, Louisiana.
*Dr. Roswell Park,	Buffalo, New York.
*Dr. John Parmenter,	Buffalo, New York.
*Dr. Lewis S. Pilcher,	Brooklyn, New York.
*Dr. Charles A. Porter,	Boston, Massachusetts.
*Dr. Charles A. Powers,	Denver, Colorado.
*Dr. Joseph Ransohoff,	Cincinnati, Ohio.
*Dr. Maurice H. Richardson,	Boston, Massachusetts.
Dr. Emmet Rixford,	San Francisco, California.
*Dr. John B. Roberts,	Philadelphia, Pennsylvania.
*Dr. William L. Rodman,	Philadelphia, Pennsylvania.
*Dr. Francis J. Shepherd,	Montreal, Canada.
Dr. Harry M. Sherman,	San Francisco, California.
*Dr. Edmond Souchon,	New Orleans, Louisiana.
Dr. Stanley Stillman,	San Francisco, California.
Dr. John E. Summers, Jr.,	Omaha, Nebraska.
*Dr. William J. Taylor,	Philadelphia, Pennsylvania.
*Dr. A. Van der Veer,	Albany, New York.
*Dr. George T. Vaughan,	Washington, D. C.
Dr. Edward W. Walker,	Cincinnati, Ohio.
*Dr. John B. Walker,	New York City.
Dr. Francis S. Watson,	Boston, Massachusetts.
*Dr. S. H. Weeks,	Portland, Maine.
*Dr. Henry R. Wharton,	Philadelphia, Pennsylvania.
*Dr. J. William White,	Philadelphia, Pennsylvania.
*Dr. George Woolsey,	New York City.

SENIOR FELLOWS.

*Dr. Oscar H. Allis,	Philadelphia, Pennsylvania.
Dr. J. M. Barton,	Philadelphia, Pennsylvania.
*Dr. William H. Carmalt,	New Haven, Connecticut.
Dr. D. W. Cheever,	Boston, Massachusetts.

*Dr. P. S. Conner,	Cincinnati, Ohio.
*Dr. George W. Gay,	Boston, Massachusetts.
*Dr. W. S. Halsted,	Baltimore, Maryland.
Dr. W. W. Keen,	Philadelphia, Pennsylvania.
Dr. Solon Marks,	Milwaukee, Wisconsin.
*Dr. William M. Mastin,	Mobile, Alabama.
*Dr. J. Ewing Mears,	Philadelphia, Pennsylvania.
*Dr. John E. Owens,	Chicago, Illinois.
*Dr. Charles B. Porter,	Boston, Massachusetts.
Dr. John D. Rushmore,	Brooklyn, New York.
Dr. Nicholas Senn,	Chicago, Illinois.
Dr. L. McLane Tiffany,	Baltimore, Maryland.
*Dr. J. Collins Warren,	Boston, Massachusetts.
Dr. Robert F. Weir,	New York City.
*Dr. DeForest Willard,	Philadelphia, Pennsylvania.

HONORARY FELLOWS.

Thomas Annandale, M.R.C.S.,	Edinburgh, Scotland.
Charles Alfred Ballance, F.R.C.S.,	London, England.
Dr. J. S. Billings,	New York City.
Thomas Bryant, Esq., F.R.C.S.,	London, England.
John Chiene, F.R.C.S.,	Edinburgh, Scotland.
Prof. Dr. Vincenz Czerny,	Heidelberg, Germany.
Prof. Dr. F. Esmarch,	Kiel, Germany.
Reginald Harrison, Esq., F.R.C.S.,	London, England.
Sir Victor A. H. Horsley,	London, England.
Prof. Dr. Theodore Kocher,	Berne, Switzerland.
Lord Joseph Lister, F.R.C.S.,	London, England.
Sir William MacEwen, M.D.,	Glasgow, Scotland.
Sir Thomas Myles, F.R.C.S.I.,	Dublin, Ireland.
Prof. Samuel Pozzi,	Paris, France.
A. W. Mayo Robson, F.R.C.S.,	London, England.
Dr. Stephen Smith,	New York City.
Prof. Felix Terrier,	Paris, France.
Prof. F. Trendelenberg,	Leipzig, Germany.

AMERICAN CLIMATOLOGICAL ASSOCIATION.

Organized, September, 1883.

ACTIVE MEMBERS.

Dr. G. E. Abbot,	Leominster, Massachusetts.
Dr. Charles D. Alton,	Hartford, Connecticut.
*Dr. Howard S. Anders,	Philadelphia, Pennsylvania.
*Dr. James M. Anders,	Philadelphia, Pennsylvania.
Dr. B. P. Anderson,	Colorado Springs, Colorado.
*Dr. Horace D. Arnold,	Boston, Massachusetts.

*Dr. R. H. Babcock,	Chicago, Illinois.
*Dr. Edward R. Baldwin,	Saranac Lake, New York.
*Dr. W. Jarvis Barlow.	Los Angeles, California.
Dr. Harry L. Barnes,	Wallum Lake, Rhode Island.
Dr. S. Westray Battle,	Asheville, North Carolina.
*Dr. William H. Bergtold,	Denver, Colorado.
*Dr. Herman M. Biggs,	New York City.
*Dr. J. S. Billings, Jr.,	New York City.
*Dr. A. D. Blackader,	Montreal, Canada.
Dr. W. S. Boardman,	Boston, Massachusetts.
Dr. S. G. Bonney,	Denver, Colorado.
*Dr. F. H. Bosworth,	New York City.
*Dr. V. Y. Bowditch,	Boston, Massachusetts.
*Dr. Henry M. Bracken,	Minneapolis, Minnesota.
*Dr. John W. Brannan,	New York City.
Dr. Norman Bridge,	Los Angeles, California.
*Dr. Lawrason Brown,	Saranac Lake, New York.
*Dr. Philip K. Brown,	San Francisco, California.
*Dr. Sanger Brown,	Chicago, Illinois.
Dr. Charles C. Browning,	Monrovia, California.
Dr. J. J. Buckley,	Missoula, Montana.
Dr. G. R. Butler,	Brooklyn, New York.
*Dr. W. A. Campbell,	Colorado Springs, Colorado.
*Dr. W. E. Casselberry,	Chicago, Illinois.
*Dr. Walter F. Chappell,	New York City.
*Dr. Thomas A. Claytor,	Washington, D. C.
Dr. Richard A. Cleeman,	Philadelphia, Pennsylvania.
Dr. J. O. Cobb, U.S.M.H.S.,	Cairo, Illinois.
*Dr. Thomas D. Coleman,	Augusta, Georgia.
Dr. Charles F. Collins,	New York City.
*Dr. A. Coolidge, Jr.,	Boston, Massachusetts.
Dr. R. W. Craig,	Phoenix, Arizona.
*Dr. R. G. Curtin,	Philadelphia, Pennsylvania.
Dr. John C. DaCosta, Jr.,	Philadelphia, Pennsylvania.
*Dr. Judson Daland,	Philadelphia, Pennsylvania.
*Dr. Thomas Darlington,	New York City.
Dr. William E. Darnall,	Atlantic City, New Jersey.
Dr. N. S. Davis,	Chicago, Illinois.
*Dr. John L. Dawson,	Charleston, South Carolina.
*Dr. Charles Denison,	Denver, Colorado.
Dr. William Duffield,	Los Angeles, California.
*Dr. William L. Dunn,	Asheville, North Carolina.
*Dr. Carroll E. Edson,	Denver, Colorado.
Dr. William A. Edwards,	Los Angeles, California.
*Dr. J. H. Elliott,	Gravenhurst, Ontario, Canada.
*Dr. H. L. Elsner,	Syracuse, New York.
*Dr. Samuel A. Fisk,	Brimfield, Massachusetts.
*Dr. Willis E. Ford,	Utica, New York.

Dr. Samuel W. French,	Milwaukee, Wisconsin.
Dr. Gustav Futterer,	Chicago, Illinois.
*Dr. C. Fox Gardiner,	Colorado Springs, Colorado.
Dr. A. S. Garnett,	Hot Springs, Arkansas.
Dr. A. C. Getchell,	Worcester, Massachusetts.
*Dr. William M. Gibson,	Utica, New York.
Dr. Walter A. Griffin,	Sharon, Massachusetts.
*Dr. George W. Guthrie,	Wilkesbarre, Pennsylvania.
Dr. Joseph N. Hall,	Denver, Colorado.
*Dr. I. H. Hance,	Lakewood, New Jersey.
*Dr. James A. Hart,	Geneva, New York.
*Dr. Thomas W. Harvey,	Orange, New Jersey.
*Dr. John L. Heffron,	Syracuse, New York.
*Dr. Guy Hinsdale,	Hot Springs, Virginia.
Dr. Henry W. Hoagland,	Colorado Springs, Colorado.
Dr. John H. Huddleston,	New York City.
*Dr. E. Fletcher Ingals,	Chicago, Illinois.
*Dr. A. Jacobi,	New York City.
*Dr. Henry B. Jacobs,	Baltimore, Maryland.
Dr. W. A. Jayne,	Denver, Colorado.
*Dr. Charles G. Jennings,	Detroit, Michigan.
Dr. Frank S. Johnson,	Chicago, Illinois.
*Dr. Herbert M. King,	Liberty, New York.
Dr. Hugh M. Kinghorn,	Saranac Lake, New York.
*Dr. Arnold C. Klebs,	Chicago, Illinois.
*Dr. Frederick I. Knight,	Boston, Massachusetts.
*Dr. D. Braden Kyle,	Philadelphia, Pennsylvania.
*Dr. S. W. Langmaid,	Boston, Massachusetts.
Dr. Egbert LeFevre,	New York City.
Dr. Walter Lindley,	Los Angeles, California.
*Dr. Wilbur T. Little,	Canon City, Colorado.
*Dr. Henry P. Loomis,	New York City.
*Dr. John H. Lowman,	Cleveland, Ohio.
Dr. B. F. Lyle,	Cincinnati, Ohio.
Dr. David R. Lyman,	Wallingford, Connecticut.
*Dr. Morris Manges,	New York City.
*Dr. Philip Marvel,	Atlantic City, New Jersey.
Dr. Thomas J. Mays,	Philadelphia, Pennsylvania.
Dr. James H. McBride,	Pasadena, California.
*Dr. C. F. McGahan,	Aiken, S. C.
Dr. James A. Miller,	New York City.
*Dr. Charles L. Minor,	Asheville, North Carolina.
*Dr. John H. Musser,	Philadelphia, Pennsylvania.
*Dr. Charles E. Nammack,	New York City.
*Dr. R. C. Newton,	Montclair, New Jersey.
Dr. Estes Nichols,	Portland, Me., and Hebron, Me.
Dr. J. B. Nichols,	Washington, D. C.
*Dr. V. H. Norrie,	New York City.

Dr. Richard J. Nunn,	Savannah, Georgia.
Dr. H. S. Orme,	Los Angeles, California.
*Dr. E. O. Otis,	Boston, Massachusetts.
*Dr. A. C. Peale,	Washington, D. C.
*Dr. Jay Perkins,	Providence, Rhode Island.
*Dr. W. F. R. Phillips,	Washington, D. C.
*Dr. Walter B. Platt,	Baltimore, Maryland.
*Dr. F. M. Pottenger,	Monrovia, California.
*Dr. Joseph H. Pratt,	Boston, Massachusetts.
Dr. John H. Pryor,	Buffalo, New York.
*Dr. Charles E. Quimby,	New York City.
Dr. C. C. Ransom,	New York City.
Dr. Boardman Reed,	Los Angeles, California.
*Dr. C. C. Rice,	New York City.
*Dr. Charles W. Richardson,	Washington, D. C.
Dr. A. J. Richer,	Montreal, Canada.
*Dr. S. D. Risley,	Philadelphia, Pennsylvania.
*Dr. William C. Rives,	Washington, D. C.
*Dr. Beverley Robinson,	New York City.
*Dr. W. D. Robinson,	Philadelphia, Pennsylvania.
*Dr. Delancey Rochester,	Buffalo, New York.
*Dr. John O. Roe,	Rochester, New York.
Dr. E. J. A. Rogers,	Denver, Colorado.
Dr. Carl von Ruck,	Asheville, North Carolina.
*Dr. William G. Schauffler,	Lakewood, New Jersey.
*Dr. Henry Sewall,	Denver, Colorado.
*Dr. E. L. Shurly,	Detroit, Michigan.
*Dr. A. Alexander Smith,	New York City.
*Dr. Frank Fremont Smith,	Washington, D. C.
*Dr. Alfred Stengel,	Philadelphia, Pennsylvania.
*Dr. Arthur K. Stone,	Boston, Massachusetts.
*Dr. J. Edward Stubbert,	New York City.
Dr. Will H. Swan,	Colorado Springs, Colorado.
*Dr. H. Longstreet Taylor,	St. Paul, Minnesota.
Dr. J. Gurney Taylor,	Philadelphia, Pennsylvania.
*Dr. J. Madison Taylor,	Philadelphia, Pennsylvania.
*Dr. James B. Walker,	Philadelphia, Pennsylvania.
Dr. E. W. Watson,	Philadelphia, Pennsylvania.
*Dr. H. H. Whitcomb,	Norristown, Pennsylvania.
Dr. Herbert B. Whitney,	Denver, Colorado.
*Dr. John A. Wilder,	Denver, Colorado.
*Dr. Francis H. Williams,	Boston, Massachusetts.
Dr. H. F. Williams,	Brooklyn, New York.
*Dr. Harold Williams,	Boston, Massachusetts.
*Dr. James C. Wilson,	Philadelphia, Pennsylvania.
*Dr. Walter Wyman,	Washington, D. C.

CORRESPONDING MEMBERS.

Dr. Carlo Colombo,	Rome, Italy.
Dr. G. G. Eyre,	Cape Town, South Africa.
Dr. Samuel Gache,	Buenos Ayres, South America.
Dr. Eduardo Liceaga,	City of Mexico, Mexico.
Dr. Domingo Orvananos,	City of Mexico, Mexico.
Fleming M. Sandwith,	London, England.
Dr. Septimus Sunderland,	London, England.
Dr. F. Parkes Weber,	London, England.
Dr. F. Creighton Wellman,	Benguella, West Africa.
Dr. Leonard Williams,	London, England.

HONORARY MEMBERS.

Dr. A. N. Bell,	Brooklyn, New York.
Dr. Edward W. Schauffler,	Kansas City, Missouri.
Dr. Andrew H. Smith,	New York City.
Dr. Edward L. Trudeau,	Saranac Lake, New York.
Dr. Hilgard Tyndale,	Lincoln, Nebraska.
Sir Hermann Weber,	London, England.
Dr. Leonard Weber,	New York City.
Dr. Charles Theodore Williams,	London, England.

ASSOCIATION OF AMERICAN PHYSICIANS.

Organized 1885.

ACTIVE MEMBERS.

*Dr. Alexander C. Abbott,	Philadelphia, Pennsylvania.
*Dr. John J. Abel,	Baltimore, Maryland.
Dr. J. George Adami,	Montreal, Canada.
*Dr. Samuel S. Adams,	Washington, D. C.
*Dr. Isaac Adler,	New York City.
*Dr. Robert H. Babcock,	Chicago, Illinois.
*Dr. L. F. Barker,	Baltimore, Maryland.
*Dr. G. Baumgarten,	St. Louis, Missouri.
*Dr. Herman M. Biggs,	New York City.
*Dr. Frank Billings,	Chicago, Illinois.
*Dr. A. D. Blackader,	Montreal, Canada.
*Dr. George Blumer,	New Haven, Connecticut.
*Dr. B. Meade Bolton,	Washington, D. C.
*Dr. Charles S. Bond,	Richmond, Indiana.
*Dr. John W. Brannan,	New York City.
Dr. Norman Bridge,	Los Angeles, California.
*Dr. Philip King Brown,	San Francisco, California.
*Dr. R. C. Cabot,	Boston, Massachusetts.
Dr. James Carroll, U. S. A.,	Washington, D. C.
Dr. Charles Cary,	Buffalo, New York.

*Dr. Henry A. Christian,	Boston, Massachusetts.
*Dr. Solomon Solis-Cohen,	Philadelphia, Pennsylvania.
Dr. Joseph Collins,	New York City.
*Dr. W. M. L. Coplin,	Philadelphia, Pennsylvania.
*Dr. Elbridge G. Cutler,	Boston, Massachusetts.
*Dr. Charles L. Dana,	New York City.
*Dr. George Dock,	Ann Arbor, Michigan.
*Dr. D. L. Edsall,	Philadelphia, Pennsylvania.
Dr. Arthur R. Edwards,	Chicago, Illinois.
*Dr. Harold C. Ernst,	Jamaica Plain, Massachusetts.
*Dr. James Ewing,	New York City.
*Dr. Frederick G. Finley,	Montreal, Canada.
*Dr. W. E. Fischel,	St. Louis, Missouri.
*Dr. Reginald H. Fitz,	Boston, Massachusetts.
Dr. Simon Flexner,	New York City.
*Dr. F. Forchheimer,	Cincinnati, Ohio.
*Dr. M. Howard Fussell,	Philadelphia, Pennsylvania.
*Dr. Thomas B. Futcher,	Baltimore, Maryland.
*Dr. H. C. Gordinier,	Troy, New York.
*Dr. Charles L. Greene,	St. Paul, Minnesota.
*Dr. J. P. Crozer Griffith,	Philadelphia, Pennsylvania.
*Dr. Hobart A. Hare,	Philadelphia, Pennsylvania.
*Dr. Ludvig Hektoen,	Chicago, Illinois.
Dr. Frederick P. Henry,	Philadelphia, Pennsylvania.
*Dr. James B. Herrick,	Chicago, Illinois.
*Dr. C. A. Herter,	New York City.
*Dr. L. E. Holt,	New York City.
Dr. Wm. T. Howard, Jr.,	Cleveland, Ohio.
*Dr. Henry Hun,	Albany, New York.
Dr. Reid Hunt,	Washington, D. C.
*Dr. Henry Jackson,	Boston, Massachusetts.
*Dr. A. Jacobi,	New York City.
*Dr. Walter B. James,	New York City.
*Dr. E. G. Janeway,	New York City.
*Dr. E. P. Joslin,	Boston, Massachusetts.
*Dr. A. O. J. Kelly,	Philadelphia, Pennsylvania.
*Dr. Francis P. Kinnicutt,	New York City.
*Dr. J. J. Kinyoun,	Glenolden, Pennsylvania.
*Dr. Geo. M. Kober,	Washington, D. C.
*Dr. Henry Koplik,	New York City.
Dr. Henri A. Lafleur,	Montreal, Canada.
*Dr. Samuel W. Lambert,	New York City.
*Dr. Morris J. Lewis,	Philadelphia, Pennsylvania.
*Dr. Morris Longstreth,	Philadelphia, Pennsylvania.
*Dr. A. B. Macallum,	Toronto, Canada.
*Dr. W. G. MacCallum,	Baltimore, Maryland.
*Dr. F. B. Mallory,	Boston, Massachusetts.
Dr. Charles F. Martin,	Montreal, Canada.
*Dr. Thomas McCrae,	Baltimore, Maryland.

*Dr. A. McPhedran,	Toronto, Canada.
*Dr. S. J. Meltzer,	New York City.
*Dr. Adolf Meyer,	New York City.
Dr. Joseph L. Miller,	Chicago, Illinois.
*Dr. John K. Mitchell,	Philadelphia, Pennsylvania.
*Dr. S. Weir Mitchell,	Philadelphia, Pennsylvania.
*Dr. John Lovett Morse,	Boston, Massachusetts.
*Dr. John H. Musser,	Philadelphia, Pennsylvania.
*Dr. W. P. Northrup,	New York City.
*Dr. F. G. Novy,	Ann Arbor, Michigan.
*Dr. E. L. Opie,	New York City.
*Dr. Wm. Osler,	Oxford, England.
*Dr. Wm. H. Park,	New York City.
*Dr. Geo. L. Peabody,	New York City.
*Dr. R. M. Pearce,	Albany, New York.
Dr. Franz Pfaff,	Boston, Massachusetts.
Dr. Robert B. Preble,	Chicago, Illinois.
*Dr. Morton Prince,	Boston, Massachusetts.
Dr. T. Mitchell Prudden,	New York City.
*Dr. James J. Putnam,	Boston, Massachusetts.
*Dr. B. K. Rachford,	Cincinnati, Ohio.
*Dr. Mark W. Richardson,	Boston, Massachusetts.
*Dr. David Riesman,	Philadelphia, Pennsylvania.
*Dr. M. J. Rosenau,	Washington, D. C.
*Dr. T. M. Rotch,	Boston, Massachusetts.
*Dr. B. Sachs,	New York City.
Dr. George G. Sears,	Boston, Massachusetts.
*Dr. Henry Sewall,	Denver, Colorado.
*Dr. Frederick C. Shattuck,	Boston, Massachusetts.
Dr. Wharton Sinkler,	Philadelphia, Pennsylvania.
*Dr. B. W. Sippy,	Chicago, Illinois.
*Dr. A. A. Smith,	New York City.
*Dr. Theobald Smith,	Boston, Massachusetts.
*Dr. T. Sollmann,	Cleveland, Ohio.
*Dr. M. Allen Starr,	New York City.
*Dr. Alfred Stengel,	Philadelphia, Pennsylvania.
*Dr. Charles G. Stockton,	Buffalo, New York.
Dr. Richard P. Strong,	Manila, Philippine Islands.
*Dr. A. E. Taylor,	San Francisco, California.
*Dr. J. S. Thacher,	New York City.
*Dr. W. S. Thayer,	Baltimore, Maryland.
*Dr. W. Gilman Thompson,	New York City.
*Dr. Wm. H. Thomson,	New York City.
*Dr. James Tyson,	Philadelphia, Pennsylvania.
*Dr. Victor C. Vaughan,	Ann Arbor, Michigan.
*Dr. Herman F. Vickery,	Boston, Massachusetts.
Dr. Samuel B. Ward,	Albany, New York.
*Dr. Aldred S. Warthin,	Ann Arbor, Michigan.
*Dr. George H. Weaver,	Chicago, Illinois.

*Dr. William H. Welch,	Baltimore, Maryland.
*Dr. F. F. Wesbrook,	Minneapolis, Minnesota.
*Dr. George Wilkins,	Montreal, Canada.
*Dr. Francis H. Williams,	Boston, Massachusetts.
*Dr. Herbert U. Williams,	Buffalo, New York.
*Dr. James C. Wilson,	Philadelphia, Pennsylvania.
*Dr. Charles F. Withington,	Boston, Massachusetts.
Dr. Horatio C. Wood,	Philadelphia, Pennsylvania.
Dr. J. H. Wright,	Boston, Massachusetts.

ASSOCIATE MEMBERS.

*Dr. Edward R. Baldwin,	Saranac Lake, New York.
*Dr. John S. Billings, Jr.,	New York City.
Dr. C. N. B. Camac,	New York City.
*Dr. Joseph A. Capps,	Chicago, Illinois.
*Dr. Lewis A. Conner,	New York City.
*Dr. Augustus A. Eshner,	Philadelphia, Pennsylvania.
*Dr. Rowland G. Freeman,	New York City.
*Dr. Samuel McC. Hamill,	Philadelphia, Pennsylvania.
Dr. Theodore Janeway,	New York City.
*Dr. E. Libman,	New York City.
Dr. I. P. Lyon,	Buffalo, New York.
*Dr. Herbert C. Moffit,	San Francisco, California.
*Dr. Joseph H. Pratt,	Boston, Massachusetts.
Dr. Robert D. Rudolf,	Toronto, Canada.
*Dr. Joseph Sailer,	Philadelphia, Pennsylvania.
*Dr. J. Dutton Steele,	Philadelphia, Pennsylvania.
Dr. Louis B. Wilson,	Rochester, Minnesota.

HONORARY MEMBERS.

Dr. A. Brayton Ball,	New York City.
Dr. John S. Billings,	New York City.
Dr. Samuel C. Chew,	Baltimore, Maryland.
Dr. Wm. T. Councilman,	Boston, Massachusetts.
Dr. Arthur C. Cushny,	London, England.
Dr. I. N. Danforth,	Chicago, Illinois.
Dr. Francis Delafield,	New York City.
Dr. Robert T. Edes,	Reading, Massachusetts.
*Dr. S. A. Fisk,	Denver, Colorado.
Dr. Charles F. Folsom,	Boston, Massachusetts.
Dr. John Guitéras,	Havana, Cuba.
Dr. I. Minis Hays,	Philadelphia, Pennsylvania.
Dr. H. M. Hurd,	Baltimore, Maryland.
Dr. Thomas S. Latimer,	Baltimore, Maryland.
*Dr. Starling Loving,	Columbus, Ohio.
Dr. A. Lawrence Mason,	Boston, Massachusetts.
Dr. Arthur V. Meigs,	Philadelphia, Pennsylvania.
*Dr. Wm. M. Polk,	New York City.

*Dr. Beverley Robinson,	New York City.
Dr. George B. Shattuck,	Boston, Massachusetts.
Dr. Andrew H. Smith,	New York City.
Dr. Louis Starr,	Philadelphia, Pennsylvania.
Dr. George M. Sternberg,	Washington, D. C.
*Dr. Edward L. Trudeau,	Saranac Lake, New York.
Dr. Henry P. Walcott,	Cambridge, Massachusetts.

AMERICAN ASSOCIATION OF GENITO-URINARY SURGEONS.

Organized, October, 1886.

ACTIVE MEMBERS.

Dr. Samuel Alexander,	New York City.
*Dr. Gardner W. Allen,	Boston, Massachusetts.
*Dr. L. Bolton Bangs,	New York City.
*Dr. W. T. Belfield,	Chicago, Illinois.
*Dr. James Bell,	Montreal, Canada.
*Dr. Charles F. Bevan,	Baltimore, Maryland.
*Dr. George E. Brewer,	New York City.
*Dr. F. Tilden Brown,	New York City.
*Dr. Edwin C. Burnett,	St. Louis, Missouri.
*Dr. Arthur T. Cabot,	Boston, Massachusetts.
*Dr. Hugh Cabot,	Boston, Massachusetts.
*Dr. N. B. Carson,	St. Louis, Missouri.
*Dr. C. H. Chetwood,	New York City.
*Dr. H. M. Christian,	Philadelphia, Pennsylvania.
*Dr. J. Bayard Clark,	New York City.
*Dr. J. H. Cunningham, Jr.,	Boston, Massachusetts.
Dr. Martin J. Echeverria,	New York City.
Dr. Francis C. Edgerton,	New York City.
*Dr. H. A. Fowler,	Washington, D. C.
Dr. Faxton E. Gardner,	New York City.
*Dr. C. L. Gibson,	New York City.
Dr. W. F. Glenn,	Nashville, Tennessee.
*Dr. Robert H. Greene,	New York City.
*Dr. Ramon Guiteras,	New York City.
*Dr. Francis R. Hagner,	Washington, D. C.
*Dr. J. R. Hayden,	New York City.
*Dr. Orville Horwitz,	Philadelphia, Pennsylvania.
*Dr. H. McC. Johnson,	St. Louis, Missouri.
Dr. William Judkins,	Cincinnati, Ohio.
*Dr. E. L. Keyes, Jr.,	New York City.
*Dr. E. E. King,	Toronto, Canada.
Dr. Bransford Lewis,	St. Louis, Missouri.
*Dr. Edward Martin,	Philadelphia, Pennsylvania.
Dr. Henry H. Morton,	Brooklyn, New York.
*Dr. Harvey G. Mudd,	St. Louis, Missouri.

*Dr. Alfred T. Osgood,	New York City.
Dr. James Pedersen,	New York City.
Dr. Abner Post,	Boston, Massachusetts.
Dr. E. Wood Ruggles,	Rochester, New York.
Dr. George K. Swinburne,	New York City.
*Dr. Louis E. Schmidt,	Chicago, Illinois.
Dr. J. Bentley Squier,	New York City.
*Dr. Robert W. Taylor,	New York City.
Dr. Paul Thorndike,	Boston, Massachusetts.
*Dr. John Van der Poel,	New York City.
*Dr. Francis S. Watson,	Boston, Massachusetts.
Dr. George S. Whiteside,	Portland, Oregon.
Dr. W. N. Wishard,	Indianapolis, Indiana.
*Dr. A. C. Wood,	Philadelphia, Pennsylvania.
*Dr. H. H. Young,	Baltimore, Maryland.

HONORARY MEMBERS.

Dr. E. L. Keyes, Sr.,	New York City.
Dr. Prince A. Morrow,	New York City.
*Dr. Roswell Park,	Buffalo, New York.
Dr. Frederick R. Sturgis,	New York City.
Dr. J. William White,	Philadelphia, Pennsylvania.

CORRESPONDING MEMBERS.

Prof. J. Albarran,	Paris, France.
Dr. Leopold Caspar,	Berlin, Germany.
Dr. E. Desnos,	Paris, France.
E. Hurry Fenwick, F. R. C. S.,	London, England.
Prof. Anton von Frisch,	Vienna, Austria.
Prof. J. C. Felix Guion,	Paris, France.
Reginald Harrison, F. R. C. S.,	London, England.
Prof. James Isreal,	Berlin, Germany.
Dr. Otto Zuckerkandl,	Vienna, Austria.

AMERICAN ORTHOPEDIC ASSOCIATION.

Organized, May, 1887.

ACTIVE MEMBERS.

*Dr. Nathaniel Allison,	St. Louis, Missouri.
*Dr. William S. Baer,	Baltimore, Maryland.
*Dr. S. C. Baldwin,	Salt Lake City, Utah.
Dr. Bernard Bartow,	Buffalo, New York.
*Dr. Wallace Blanchard,	Chicago, Illinois.
Dr. W. E. Blodgett,	Detroit, Michigan.
Dr. E. G. Brackett,	Boston, Massachusetts.
*Dr. E. H. Bradford,	Boston, Massachusetts.

*Dr. Ansel G. Cook,	Hartford, Connecticut.
Dr. Frederick S. Coolidge,	Pittsfield, Massachusetts.
Dr. John Dane,	Boston, Massachusetts.
*Dr. Gwilym G. Davis,	Philadelphia, Pennsylvania.
Dr. G. R. Elliott,	New York City.
*Dr. Leonard W. Ely,	New York City.
*Dr. P. H. Fitzhugh,	New York City.
*Dr. A. H. Freiberg,	Cincinnati, Ohio.
*Dr. H. P. Galloway,	Winnipeg, Canada.
*Dr. Emil S. Geist,	Minneapolis, Minnesota.
*Dr. Virgil P. Gibney,	New York City.
Dr. Arthur J. Gillette,	St. Paul, Minnesota.
*Dr. J. E. Goldthwait,	Boston, Massachusetts.
*Dr. J. D. Griffith,	Kansas City, Missouri.
Dr. Philip Hoffman,	St. Louis, Missouri.
*Dr. Charles H. Jaeger,	New York City.
Dr. A. B. Judson,	New York City.
*Dr. Robert W. Lovett,	Boston, Massachusetts.
*Dr. Stewart L. McCurdy,	Pittsburg, Pennsylvania.
*Dr. B. E. McKenzie,	Toronto, Canada.
*Dr. T. Halsted Myers,	New York City.
*Dr. C. D. Napier,	Brooklyn, New York.
*Dr. Robert B. Osgood,	Boston, Massachusetts.
Dr. George B. Packard,	Denver, Colorado.
*Dr. Charles F. Painter,	Boston, Massachusetts.
*Dr. Roswell Park,	Buffalo, New York.
*Dr. F. E. Peckham,	Providence, Rhode Island.
*Dr. J. L. Porter,	Chicago, Illinois.
*Dr. John Ridlon,	Chicago, Illinois.
*Dr. Compton Riely,	Baltimore, Maryland.
*Dr. J. Torrance Rugh,	Philadelphia, Pennsylvania.
Dr. E. W. Ryerson,	Chicago, Illinois.
*Dr. Reginald H. Sayre,	New York City.
Dr. J. C. Schapps,	Butte, Montana.
*Dr. Newton M. Shaffer,	New York City.
*Dr. A. R. Shands,	Washington, D. C.
Dr. H. M. Sherman,	San Francisco, California.
*Dr. David Silver,	Pittsburg, Pennsylvania.
*Dr. Robert Soutter,	Boston, Massachusetts.
*Dr. J. M. Spellissy,	Philadelphia, Pennsylvania.
*Dr. C. L. Starr,	Toronto, Canada.
*Dr. A. J. Steele,	St. Louis, Missouri.
*Dr. W. G. Stern,	Cleveland, Ohio.
*Dr. Henry L. Taylor,	New York City.
*Dr. R. Tunstall Taylor,	Baltimore, Maryland.
*Dr. William J. Taylor,	Philadelphia, Pennsylvania.
*Dr. Augustus Thorndike,	Boston, Massachusetts.
*Dr. W. R. Townsend,	New York City.

*Dr. Charlton Wallace,	New York City.
Dr. J. H. Waterman,	New York City.
Dr. James T. Watkins,	San Francisco, California.
*Dr. Royal Whitman,	New York City.
*Dr. H. Augustus Wilson,	Philadelphia, Pennsylvania.
*Dr. James K. Young,	Philadelphia, Pennsylvania.

CORRESPONDING MEMBERS.

Dr. M. Bilhaut,	Paris, France.
Dr. A. Codivilla,	Bologna, Italy.
Dr. Julius Dollinger,	Buda-Pest, Hungary.
Prof. Dr. Galeazzi,	Milan, Italy.
Dr. A. Hoffa,	Berlin, Germany.
*Mr. Robert Jones,	Liverpool, England.
Mr. C. B. Keetley,	London, England.
Dr. E. Kirmission,	Paris, France.
Dr. Sigfrid Levy,	Copenhagen, Denmark.
Mr. Ernest M. Little,	London, England.
Dr. Adolph Lorenz,	Vienna, Austria.
Mr. Howard Marsh,	London, England.
Mr. Edmund Owen,	London, England.
Mr. Robert W. Parker,	West Grinstead, Sussex, England.
Dr. Paul Redard,	Paris, France.
Mr. Bernard Roth,	London, England.
Dr. W. Schulthess,	Zurich, Switzerland.
Mr. Alfred H. Tubby,	London, England.
Dr. Oscar Vulpius,	Heidelberg, Germany.
Mr. George A. Wright,	Manchester, England.
Dr. L. Wullstein,	Halle A. S., Germany.

HONORARY MEMBERS.

*Dr. H. L. Burrell,	Boston, Massachusetts.
Dr. O. Lannelongue,	Paris, France.
Dr. Benjamin Lee,	Philadelphia, Pennsylvania.
Mr. William MacEwen,	Glasgow, Scotland.
*Dr. James E. Moore,	Minneapolis, Minnesota.
*Dr. Deforest Willard,	Philadelphia, Pennsylvania.

AMERICAN PHYSIOLOGICAL SOCIETY.

Organized, December, 1887.

ACTIVE MEMBERS.

*Dr. Alexander C. Abbott,	Philadelphia, Pennsylvania.
*Dr. John J. Abel,	Baltimore, Maryland.
Dr. John George Adami,	Montreal, Canada.
Dr. Thomas B. Aldrich,	Detroit, Michigan.

Dr. Carl L. Alsberg,	Boston, Massachusetts.
Dr. Samuel Amberg,	Baltimore, Maryland.
Dr. Roswell Parker Angier,	New Haven, Connecticut.
Dr. Henry Prentiss Armsby,	State College, Pennsylvania.
Dr. W. O. Atwater,	Middletown, Connecticut.
Dr. John Auer,	New York City.
*Dr. Silas Palmer Beebe,	New York City.
Dr. Francis Gano Benedict,	Boston, Massachusetts.
Dr. Henry G. Beyer,	Washington, D. C.
*Dr. Henry Pickering Bowditch,	Boston, Massachusetts.
Dr. Leo Breisacher,	Detroit, Michigan.
Dr. Orville Harry Brown,	St. Louis, Missouri.
Dr. Albert P. Brubaker,	Philadelphia, Pennsylvania.
Dr. Russell Burton-Opitz,	New York City.
Dr. Frederick Carl Busch,	Buffalo, New York.
Dr. John P. Campbell,	Athens, Georgia.
Dr. Walter B. Cannon,	Boston, Massachusetts.
Dr. A. J. Carlson,	Chicago, Illinois.
Dr. Alexis Carrell,	New York City.
Dr. William S. Carter,	Galveston, Texas.
Dr. J. McKeen Cattell,	Garrison-on-Hudson, New York.
Dr. Henry C. Chapman,	Philadelphia, Pennsylvania.
Dr. Russell H. Chittenden,	New Haven, Connecticut.
Dr. Gaylord P. Clark,	Syracuse, New York.
Dr. Allen M. Cleghorn,	Cambridge, Massachusetts.
Dr. R. H. Cunningham,	New York City.
Dr. John G. Curtis,	New York City.
*Dr. Harvey Cushing,	Baltimore, Maryland.
Dr. Arthur R. Cushny,	London, England.
Dr. Percy Millard Dawson,	Baltimore, Maryland.
*Dr. Henry Herbert Donaldson,	Philadelphia, Pennsylvania.
Dr. George P. Dreyer,	Chicago, Illinois.
Dr. Charles W. Edmunds,	Ann Arbor, Michigan.
Dr. Joseph Erlanger,	Madison, Wisconsin.
Dr. Fred W. Ellis,	Monson, Massachusetts.
*Dr. J. A. E. Eyster,	Baltimore, Maryland.
Dr. Martin H. Fischer,	Oakland, California.
Dr. George Wells Fitz,	Boston, Massachusetts.
*Dr. Otto Folin,	Waverley, Massachusetts.
*Dr. Shepherd Ivory Franz,	Washington, D. C.
*Dr. William J. Gies,	New York City.
Dr. George Lincoln Goodale,	Cambridge, Massachusetts.
Dr. Charles Wilson Greene,	Columbia, Missouri.
Dr. Charles Claude Guthrie,	St. Louis, Missouri.
Dr. Winfield S. Hall,	Chicago, Illinois.
Dr. John T. Halsey,	New Orleans, Louisiana.
Dr. Hobart Amory Hare,	Philadelphia, Pennsylvania.
Dr. Ross Granville Harrison,	New Haven, Connecticut.
Dr. Howard Davis Haskins,	Cleveland, Ohio.

Dr. Shinkishi Hatai,	Philadelphia, Pennsylvania.
Dr. Robert A. Hatcher,	New York City.
Dr. Philip B. Hawk,	Philadelphia, Pennsylvania.
*Dr. Velyien E. Henderson,	Toronto, Canada.
*Dr. Yandell Henderson,	New Haven, Connecticut.
*Dr. Christian A. Herter,	New York City.
Dr. Clifton F. Hodge,	Worcester, Massachusetts.
*Dr. Donald R. Hooker,	Baltimore, Maryland.
Dr. Theodore Hough,	Charlottesville, Virginia.
*Dr. E. Mark Houghton,	Detroit, Michigan.
*Dr. W. H. Howell,	Baltimore, Maryland.
Dr. G. Carl Huber,	Ann Arbor, Michigan.
Dr. Reid Hunt,	Washington, D. C.
Dr. Ida H. Hyde,	Lawrence, Kansas.
*Dr. Holmes Condict Jackson,	Albany, New York.
Dr. Oliver P. Jenkins,	Stanford University, California.
Dr. H. S. Jennings,	Baltimore, Maryland.
Dr. Walter Jones,	Baltimore, Maryland.
Dr. Edwin Oakes Jordan,	Chicago, Illinois.
*Dr. Joseph H. Kastle,	Washington, D. C.
Dr. George T. Kemp,	Champaign, Illinois.
Dr. Waldemar Koch,	Chicago, Illinois.
*Dr. Frederic S. Lee,	New York City.
Dr. Phœbus A. Levene,	New York City.
*Dr. Isaac Levin,	New York City.
Dr. Ralph S. Lillie,	Baltimore, Maryland.
Dr. D. J. Lingle,	Chicago, Illinois.
Dr. Frank Spiller Locke,	Stanbury, Torquay, England.
Dr. Jacques Loeb,	Berkeley, California.
*Dr. A. S. Loevenhart,	Baltimore, Maryland.
Dr. Warren P. Lombard,	Ann Arbor, Michigan.
*Dr. Graham Lusk,	New York City.
Dr. Elias P. Lyon,	St. Louis, Missouri.
*Dr. A. B. Macallum,	Toronto, Canada.
Dr. J. J. R. Macleod,	Cleveland, Ohio.
Dr. Franklin P. Mall,	Baltimore, Maryland.
*Dr. John A. Mandel,	New York City.
*Dr. John Marshall,	Philadelphia, Pennsylvania.
Dr. Ernest G. Martin,	Boston, Massachusetts.
Dr. Albert P. Mathews,	Chicago, Illinois.
*Dr. Samuel A. Matthews,	Chicago, Illinois.
Dr. E. Lindon Mellus,	Baltimore, Maryland.
*Dr. S. J. Meltzer,	New York City.
*Dr. Lafayette B. Mendel,	New Haven, Connecticut.
Dr. Wesley Mills,	Montreal, Canada.
Dr. Charles Sedgwick Minot,	Boston, Massachusetts.
*Dr. S. Weir Mitchell,	Philadelphia, Pennsylvania.
Dr. John Raymond Murlin,	New York City.

*Dr. Frederick G. Novy,	Ann Arbor, Michigan.
*Dr. Eugene L. Opie,	New York City.
Dr. Thomas B. Osborne,	New Haven, Connecticut.
*Dr. William Osler,	Oxford, England.
*Dr. Isaac Ott,	Easton, Pennsylvania.
Dr. George Howard Parker,	Cambridge, Massachusetts.
Dr. William H. Parker,	Boston, Massachusetts.
Dr. Franz Pfaff,	Boston, Massachusetts.
Dr. Walter Bowers Pillsbury,	Ann Arbor, Michigan.
Dr. William Townsend Porter,	Boston, Massachusetts.
Dr. Edward T. Reichert,	Philadelphia, Pennsylvania.
Dr. Alfred N. Richards,	New York City.
Dr. William Salant,	New York City.
Dr. Wm. Thompson Sedgwick,	Boston, Massachusetts.
*Dr. Henry Sewall,	Denver, Colorado.
*Dr. Philip A. Shaffer,	New York City.
Dr. Charles E. Simon,	Baltimore, Maryland.
*Dr. Herbert E. Smith,	New Haven, Connecticut.
*Dr. Torald Sollmann,	Cleveland, Ohio.
Dr. Colin C. Stewart,	Hanover, New Hampshire.
Dr. G. N. Stewart,	Chicago, Illinois.
Dr. Percy Goldthwait Stiles,	Boston, Massachusetts.
Dr. Lyman B. Stookey,	Los Angeles, California.
*Dr. Thomas A. Storey,	New York City.
Dr. Oliver Perkins Terry,	West Lafayette, Indiana.
Dr. Frank Pell Underhill,	New Haven, Connecticut.
*Dr. Victor C. Vaughan,	Ann Arbor, Michigan.
Dr. Swale Vincent,	Winnipeg, Canada.
Dr. Alfred J. Wakeman,	Greenwich, Connecticut.
Dr. George B. Wallace,	New York City.
Dr. Joseph W. Warren,	Bryn Mawr, Pennsylvania.
*Dr. William H. Welch,	Baltimore, Maryland.
*Dr. Frank Fairchild Wesbrook,	Minneapolis, Minnesota.
*Dr. Charles G. L. Wolf,	New York City.
Dr. Horatio C. Wood,	Philadelphia, Pennsylvania.
Dr. R. S. Woodworth,	New York City.
Dr. Robert M. Yerkes,	Cambridge, Massachusetts.

HONORARY MEMBERS.

Prof. A. Dastre,	Paris, France.
Prof. Th. W. Engelmann,	Berlin, Germany.
Prof. F. Hofmeister,	Strassburg, Germany.
Prof. J. N. Langley,	Cambridge, England.
Prof. J. P. Pawlow,	St. Petersburg, Russia.
Prof. C. S. Sherrington,	Liverpool, England.

AMERICAN PEDIATRIC SOCIETY.

Organized, September 18, 1888.

ACTIVE MEMBERS.

Dr. Isaac Abt,	Chicago, Illinois.
*Dr. George N. Acker,	Washington, D. C.
*Dr. Samuel S. Adams,	Washington, D. C.
*Dr. Allen Baines,	Toronto, Canada.
*Dr. A. D. Blackader,	Montreal, Canada.
*Dr. William D. Booker,	Baltimore, Maryland.
Dr. David Bovaird,	New York City.
Dr. E. M. Buckingham,	Boston, Massachusetts.
Dr. Augustus Caillé,	New York City.
*Dr. Walter L. Carr,	New York City.
Dr. Henry D. Chapin,	New York City.
*Dr. F. S. Churchill,	Chicago, Illinois.
Dr. A. C. Cotton,	Chicago, Illinois.
*Dr. Floyd M. Crandall,	New York City.
Dr. John Dorning,	New York City.
*Dr. Charles H. Dunn,	Boston, Massachusetts.
*Dr. Percival J. Eaton,	Pittsburg, Pennsylvania.
*Dr. David L. Edsall,	Philadelphia, Pennsylvania.
Dr. Charles A. Fife,	Philadelphia, Pennsylvania.
*Dr. F. Forchheimer,	Cincinnati, Ohio.
*Dr. Rowland G. Freeman,	New York City.
*Dr. E. E. Graham,	Philadelphia, Pennsylvania.
*Dr. J. P. Crozer Griffith,	Philadelphia, Pennsylvania.
*Dr. S. McC. Hamill,	Philadelphia, Pennsylvania.
Dr. Alfred Hand, Jr.,	Philadelphia, Pennsylvania.
*Dr. L. Emmett Holt,	New York City.
*Dr. John Howland,	New York City.
Dr. F. Huber,	New York City.
*Dr. A. Jacobi,	New York City.
*Dr. Charles G. Jennings,	Detroit, Michigan.
*Dr. Charles G. Kerley,	New York City.
*Dr. J. H. M. Knox,	Baltimore, Maryland.
*Dr. Henry Koplik,	New York City.
*Dr. Maynard Ladd,	Boston, Massachusetts.
*Dr. L. E. LaFétra,	New York City.
Dr. John H. McCollum,	Boston, Massachusetts.
Dr. C. F. Martin,	Montreal, Canada.
Dr. Frank S. Meara,	New York City.
Dr. D. J. Milton Miller,	Philadelphia, Pennsylvania.
*Dr. J. Lovett Morse,	Boston, Massachusetts.
*Dr. William P. Northrup,	New York City.
*Dr. Charles P. Putnam,	Boston, Massachusetts.
*Dr. B. K. Rachford,	Cincinnati, Ohio.
*Dr. Thomas M. Rotch,	Boston, Massachusetts.

*Dr. John Ruhräh,	Baltimore, Maryland.
*Dr. E. W. Saunders,	St. Louis, Missouri.
*Dr. Henry L. K. Shaw,	Albany, New York.
Dr. Irving M. Snow,	Buffalo, New York.
*Dr. Thomas S. Southworth,	New York City.
Dr. Louis Starr,	Philadelphia, Pennsylvania.
*Dr. Charles W. Townsend,	Boston, Massachusetts.
Dr. A. H. Wentworth,	Boston, Massachusetts.
*Dr. J. Park West,	Bellaire, Ohio.
Dr. Thompson S. Westcott,	Philadelphia, Pennsylvania.
*Dr. Harold Williams,	Boston, Massachusetts.
*Dr. W. Reynolds Wilson,	Philadelphia, Pennsylvania.
Dr. J. E. Winters,	New York City.

HONORARY MEMBERS.

Dr. Henry Ashby,	Manchester, England.
Prof. A. Baginsky,	Berlin, Germany.
Dr. Escherich,	Vienna, Austria.
Dr. O. Heubner,	Berlin, Germany.
Prof. V. Hutinel,	Paris, France.
*Dr. William Osler,	Oxford, England.
Dr. George F. Still,	London, England.
Dr. John Thomson,	Edinburgh, Scotland.

AMERICAN MEDICO-PSYCHOLOGICAL ASSOCIATION.

Organized 1844; Re-organized 1892.

ACTIVE MEMBERS AND ASSOCIATES.

Dr. E. Stanley Abbot,	Waverley, Massachusetts.
Dr. Florence H. Abbot,	Taunton, Massachusetts.
Dr. George S. Adams,	Westborough, Massachusetts.
Dr. George Sheldon Adams,	Yankton, South Dakota.
Dr. W. Herbert Adams,†	Savannah, Georgia.
Dr. Charles L. Allen,	Trenton, New Jersey.
*Dr. Henry D. Allen,	Milledgeville,, Georgia.
Dr. Wilmer L. Allison,†	San Antonio, Texas.
Dr. Clayton G. Andrews,†	Burlington, Vermont.
*Dr. James V. Anglin,	St. John, New Brunswick.
Dr. Charles F. Applegate,	Mt. Pleasant, Iowa.
Dr. George G. Armstrong,†	Buffalo, New York.
Dr. Daniel H. Arthur,	Gowanda, New York.
*Dr. Maurice C. Ashley,	Middletown, New York.
Dr. Henry S. Atkins,	St. Louis, Missouri.
Dr. Charles E. Atwood,†	New York City.
Dr. James B. Ayer,	Boston, Massachusetts.
Dr. J. W. Babcock,	Columbia, South Carolina.

Dr. Benjamin W. Baker,†	Taunton, Massachusetts.
Dr. Jane R. Baker,	Embreeville, Pennsylvania.
Dr. Raymond D. Baker,†	Morris Plains, New Jersey.
Dr. Henry C. Baldwin,	Boston, Massachusetts.
*Dr. Eveline P. Ballintine,†	Rochester, New York.
Dr. Thomas E. Bamford,†	Syracuse, New York.
*Dr. Charles P. Bancroft,	Concord, New Hampshire.
Dr. H. L. Barnes,	Wallum Lake, Rhode Island.
*Dr. Albert M. Barrett,	Ann Arbor, Michigan.
Dr. P. Challis Bartlett,†	Worcester, Massachusetts.
Dr. John A. Beauchamp,	Nashville, Tennessee.
Dr. W. F. Becker,	Milwaukee, Wisconsin.
Dr. Nelson H. Beemer,	Toronto, Canada.
Dr. Christopher C. Beling,	Morris Plains, New Jersey.
Dr. Alice Bennett,	Brooklyn, New York.
Dr. Henry J. Berkley,	Baltimore, Maryland.
Dr. Joseph B. Betts,†	Buffalo, New York.
*Dr. W. F. Beutler,	Wauwatosa, Wisconsin.
Dr. I. W. Blackburn,	Washington, D. C.
*Dr. G. Alder Blumer,	Providence, Rhode Island.
Dr. James R. Bolton,	Fishkill-on-Hudson, New York.
Dr. George F. M. Bond,	Yonkers, New York.
Dr. Eugene D. Bondurant,	Mobile, Alabama.
*Dr. Isabel A. Bradley,†	Columbus, Ohio.
Dr. Lloyd V. Briggs,	Boston, Massachusetts.
*Dr. D. M. Brochu,	Beauport, Quebec, Canada.
Dr. Ida. J. Brooks,†	Westborough, Massachusetts.
Dr. D. R. Brower,	Chicago, Illinois.
Dr. Edison C. Brown,†	Massillon, Ohio.
Dr. John P. Brown,	Taunton, Massachusetts.
*Dr. Sanger Brown,	Chicago, Illinois.
*Dr. W. Stuart Brown,	Flushing, New York.
Dr. Albert E. Brownrigg,	Nashua, New Hampshire.
*Dr. Edward N. Brush,	Towson, Maryland.
Dr. Percy Bryant,	Brooklyn, New York.
Dr. H. E. Buchan,†	London, Ontario, Canada.
Dr. J. M. Buchanan,	Meridian, Mississippi.
*Dr. E. L. Bullard,	Milwaukee, Wisconsin.
Dr. Charles M. Burdick,†	Ogdensburg, New York.
*Dr. T. J. W. Burgess,	Montreal, Canada.
Dr. Anne Burnet,	Mt. Pleasant, Iowa.
*Dr. C. B. Burr,	Flint, Michigan.
*Dr. Charles W. Burr,	Philadelphia, Pennsylvania.
Dr. Dwight R. Burrell,	Canandaigua, New York.
*Dr. A. P. Busey,	Pueblo, Colorado.
Dr. Daniel H. Calder,	Provo City, Utah.
Dr. L. H. Callaway,	Nevada, Missouri.
Dr. Earl H. Campbell,	Newberry, Michigan.
Dr. George B. Campbell,†	New York City.

Dr. Merritt B. Campbell,	Los Angeles, California.
Dr. Michael Campbell,	Knoxville, Tennessee.
*Dr. Byron M. Caples,	Waukesha, Wisconsin.
Dr. Harris M. Carey,†	Retreat, Luzerne County, Pa.
Dr. Chester L. Carlisle,†	Willard, New York.
Dr. Henry B. Carriel,	Jacksonville, Illinois.
Dr. Henry F. Carriel,	Jacksonville, Illinois.
Dr. Charles G. Chaddock,	St. Louis, Missouri.
Dr. E. Philippe Chagnon,	Montreal, Canada.
Dr. G. L. Chamberlain,	Newberry, Michigan.
Dr. Walter Channing,	Brookline, Massachusetts.
Dr. John B. Chapin,	Philadelphia, Pennsylvania.
*Dr. Robert H. Chase,	Philadelphia, Pennsylvania.
Dr. William A. Cheatham,	Nashville, Tennessee.
Dr. G. A. Chilgren,	Sauk Rapids, Minnesota.
Dr. Edmund A. Christian,	Pontiac, Michigan.
Dr. Mary Christiancy,†	Norristown, Pennsylvania.
Dr. Charles H. Clark,†	Cleveland, Ohio.
*Dr. Joseph C. Clark,	Sykesville, Maryland.
Dr. L. Pierce Clark,	New York City.
Dr. Charles K. Clarke,	Toronto, Canada.
Dr. Homer E. Clarke,†	Pontiac, Michigan.
*Dr. Henry W. Coe,	Portland, Oregon.
Dr. Jesse C. Coggins,†	Laurel, Maryland.
Dr. Fred B. Colby,†	Highland Falls, New York.
Dr. Arthur B. Coleburn,†	Middletown, Connecticut.
Dr. William W. Coles,†	Westborough, Massachusetts.
Dr. George F. Cook,	Oxford, Ohio.
Dr. R. Harvey Cook,	Oxford, Ohio.
Dr. Owen Copp,	Boston, Massachusetts.
Dr. Isador H. Coriat,	Boston, Massachusetts.
Dr. Paul L. Cort,†	Trenton, New Jersey.
Dr. H. Austin Cossitt,†	Morris Plains, New Jersey.
Dr. Harry A. Cotton,†	Hathorne, Massachusetts.
Dr. J. Elvin Courtney,	Denver, Colorado,
Dr. Edward Cowles,	Boston, Massachusetts.
Dr. George C. Crandall,	St. Louis, Missouri.
*Dr. W. P. Crumbacker,	Independence, Iowa.
Dr. Frederick H. Daniels,†	Batavia, Illinois.
Dr. W. H. Darling,†	St. Peter, Minnesota.
Dr. Rolland F. Darnall,†	Pueblo, Colorado.
Dr. Arthur C. Delacroix,†	Brooklyn, New York.
Dr. Cornelius DeWeese,†	Laurel, Maryland.
Dr. Charles G. Dewey,	Dorchester, Massachusetts.
*Dr. Richard Dewey,	Wauwatosa, Wisconsin.
Dr. Oliver Dewing,	Brooklyn, New York.
Dr. Allen R. Diefendorf,	Middletown, Connecticut.
*Dr. D. M. Dill,	Newark, New Jersey.
Dr. Charles E. Doherty,	New Westminster, Br. Columbia.

*Dr. William E. Dold,	Astoria, Long Island.
Dr. Robert E. Doran,	Willard, New York.
Dr. A. E. Douglas,†	Nashville, Tennessee.
Dr. Dana F. Downing,†	West Newton, Massachusetts.
Dr. Charles A. Drew,	State Farm, Massachusetts.
*Dr. William F. Drewry,	Petersburg, Virginia.
*Dr. William R. Dunton, Jr.,	Towson, Maryland.
Dr. Albert Durham,†	White Plains, New York.
Dr. B. D. Eastman,	Topeka, Kansas.
Dr. George F. Edenharter,	Indianapolis, Indiana.
Dr. J. Frank Edgerly,	Newtonville, Massachusetts.
Dr. John B. Edwards,	Mauston, Wisconsin.
Dr. Hiram Elliott,	Troy, New York.
*Dr. Robert M. Elliott,	Willard, New York.
Dr. Justin E. Emerson,	Detroit, Michigan.
*Dr. Augustus A. Eshner,	Philadelphia, Pennsylvania.
*Dr. B. D. Evans,	Morris Plains, New Jersey.
Dr. H. C. Eyman,	Massillon, Ohio.
Dr. W. W. Faison,	Goldsboro, North Carolina.
Dr. John C. Felty,†	Trenton, New Jersey.
Dr. Guy G. Fernald,†	Waverley, Massachusetts.
Dr. Walter E. Fernald,	Waverley, Massachusetts.
Dr. E. Moore Fisher,†	Morris Plains, New Jersey.
Dr. Theodore W. Fisher,	Boston, Massachusetts.
Dr. John F. Fitzgerald,	Brooklyn, New York.
Dr. John G. Fitzgerald,†	Toronto, Canada.
Dr. Austin Flint,	New York City.
*Dr. Everett Flood,	Palmer, Massachusetts.
Dr. L. S. Foster,	Williamsburg, Virginia.
Dr. Charles M. Franklin,	Baltimore, Maryland.
*Dr. Edward French,	Harding, Massachusetts.
Dr. Henry P. Frost,†	Buffalo, New York.
*Dr. Frank F. Fry,	St. Louis, Missouri.
Dr. Solomon C. Fuller,†	Westborough, Massachusetts.
Dr. J. H. Garlick,†	Staunton, Virginia.
Dr. R. Edward Garrett,†	Catonsville, Maryland.
Dr. Robert L. Gillespie,	Portland, Oregon.
Dr. Walter R. Gillette,	New York City.
Dr. A. J. Givens,	Stamford, Connecticut.
Dr. John W. Givens,	Orofino, Idaho.
Dr. Harold C. Goodwin,†	Concord, New Hampshire.
Dr. V. L. Goodwill,	Charlottetown, Prince Edward Island.
Dr. W. A. Gordon,	Winnebago, Wisconsin.
*Dr. Charles Gorst,	Mendota, Wisconsin.
Dr. Eliot Gorton,	Summit, New Jersey.
Dr. Arthur V. Goss,	Taunton, Massachusetts.
Dr. William D. Granger,	Bronxville, New York.
Dr. Marvin L. Graves,	Galveston, Texas.

Dr. Edward M. Green,†	Milledgeville, Georgia.
*Dr. Alfred T. Gundry,	Catonsville, Maryland.
*Dr. Richard F. Gundry,.	Catonsville, Maryland.
*Dr. Morris S. Guth,	Warren, Pennsylvania.
*Dr. L. V. Guthrie,	Huntington, West Virginia.
Dr. Henry C. Hall,†	Providence, Rhode Island.
Dr. Lemuel T. Hall,	Farmington, Missouri.
Dr. Gilbert V. Hamilton,†	Waverley, Massachusetts.
*Dr. Samuel W. Hamilton,†	New York City.
*Dr. W. H. Hancker,	Farnhurst, Delaware.
Dr. Edward L. Hanes,†	Rochester, New York.
Dr. George T. Harding, Jr.,	Washington, D. C.
*Dr. F. W. Harmon,	Carthage, Ohio.
*Dr. Arthur H. Harrington,	New York City.
*Dr. Isham G. Harris,	Poughkeepsie, New York.
Dr. Daniel A. Harrison,	Whitestone, New York.
Dr. W. H. Hattie,	Halifax, Nova Scotia.
Dr. Clarence F. Haviland,†	New York City.
Dr. Marcus B. Heyman,	Central Islip, New York.
Dr. Charles E. Hickey,	Cobourg, Ontario, Canada.
*Dr. J. L. Hildreth,	Cambridge, Massachusetts.
*Dr. Charles G. Hill,	Baltimore, Maryland.
Dr. Gershom H. Hill,	Des Moines, Iowa.
Dr. Horace B. Hill,†	Augusta, Maine.
*Dr. S. S. Hill,	Wernersville, Pennsylvania.
*Dr. Frederick L. Hills,†	Rutland, Massachusetts.
Dr. L. S. Hinckley,	Newark, New Jersey.
Dr. William Hirsch,	New York City.
Dr. Charles W. Hitchcock,	Detroit, Michigan.
Dr. Alfred T. Hobbs,	Guelph, Ontario, Canada.
*Dr. August Hoch,†	White Plains, New York.
Dr. Theodore A. Hoch,†	Worcester, Massachusetts.
Dr. Erving Holley,†	Willard, New York.
*Dr. John A. Houston,	Northampton, Massachusetts.
Dr. A. B. Howard,	Cleveland, Ohio.
Dr. Eugene H. Howard,	Rochester, New York.
Dr. Herbert B. Howard,	Boston, Massachusetts.
Dr. Joseph B. Howland,	Gardner, Massachusetts.
Dr. Charles H. Hughes,	St. Louis, Missouri.
Dr. Harry R. Hummer,†	Washington, D. C.
*Dr. Arthur W. Hurd,	Buffalo, New York.
Dr. Henry M. Hurd,	Baltimore, Maryland.
*Dr. Richard H. Hutchings,	Ogdensburg, New York.
Dr. Anna E. Hutchinson,†	New York City.
Dr. Henry A. Hutchinson,	Dixmont, Pennsylvania.
Dr. Marcello Hutchinson,	Waterbury, Vermont.
Dr. Clifford J. Huyck,†	Gilbertville, Massachusetts.
Dr. George F. Inch,†	Kalamazoo, Michigan.
Dr. Arthur C. Jelly,	Boston, Massachusetts.

Dr. George F. Jelly,	Boston, Massachusetts.
Dr. Morris J. Karpas,†	New York City.
Dr. Frank L. Keith,	Flat River, Missouri.
Dr. Theodore H. Kellogg,	Riverdale-on-Hudson, New York.
Dr. James F. Kelly,†	Cleveland, Ohio.
Dr. Arthur F. Kilbourne,	Rochester, Minnesota.
*Dr. J. Joseph Kindred,	Astoria, New York.
Dr. C. Spencer Kinney,	Easton, Pennsylvania.
Dr. George M. Kline,†	Ann Arbor, Michigan.
*Dr. Henry I. Klopp,†	Westborough, Massachusetts.
Dr. John R. Knapp,†	New York City.
Dr. George H. Knight,	Lakeville, Connecticut.
Dr. W. M. Knowlton,	Brookline, Massachusetts.
Dr. Helene J. C. Kuhlman,†	Buffalo, New York.
Dr. William F. Kuhn,	Farmington, Missouri.
Dr. A. H. Kunst,	Weston, West Virginia.
Dr. Robert B. Lamb,	Fishkill Landing, New York.
Dr. Charles T. LaMoure,†	Rochester, New York.
Dr. Edward B. Lane,	Boston, Massachusetts.
Dr. F. W. Langdon,	Cincinnati, Ohio.
Dr. Charles E. Laughlin,	Evansville, Indiana.
*Dr. Frederick E. Lawlor,†	Halifax, Nova Scotia.
*Dr. Shailer E. Lawton,	Brattleboro, Vermont.
Dr. Roy L. Leak,†	Ogdensburg, New York.
Dr. J. M. Lewis,	Cleveland, Ohio.
Dr. Benjamin R. Logie,†	Washington, D. C.
Dr. Oscar R. Long,	Ionia, Michigan.
*Dr. Seymour D. Ludlum,†	Philadelphia, Pennsylvania.
Dr. Samuel B. Lyon,	White Plains, New York.
Dr. A. J. Lyons,	Spencer, West Virginia.
*Dr. William Mabon,	New York City.
Dr. Charles B. Macartney,†	Flint, Michigan.
Dr. G. A. MacCallum,	London, Ontario, Canada.
Dr. DeWitt C. MacClymont,†	Kings Park, New York.
Dr. Carlos F. MacDonald,	New York City.
Dr. Mitchell C. Mackin,†	Clarinda, Iowa.
Dr. James A. Mackintosh,	Worcester, Massachusetts.
Dr. Andrew Macphail,†	Montreal, Canada.
Dr. James H. McBride,	Pasadena, California.
*Dr. William McDonald,	Providence, Rhode Island.
Dr. James M. McGeorge,†	Massillon, Ohio.
Dr. Arthur McGugan,	Denver, Colorado.
Dr. James McKee,	Raleigh, North Carolina.
Dr. John I. McKelway,†	Kings Park, New York.
Dr. Clyde R. McKinniss,†	Norristown, Pennsylvania.
Dr. Eugene C. McNicholl,	Cobourg, Ontario, Canada.
Dr. William A. Macy,	Kings Park, New York.
Dr. Frank H. Magness,†	New York City.
Dr. Peter S. Mallon,	Morris Plains, New Jersey.

Dr. G. H. Manchester,	New Westminster, Br. Columbia.
*Dr. Walter P. Manton,	Detroit, Michigan.
Dr. George H. Maxfield,†	Mattapan, Massachusetts.
Dr. T. O. Maxwell,†	San Antonio, Texas.
Dr. Charles B. Mayberry,	Retreat, Luzerne Co., Pennsylvania.
Dr. Edward E. Mayer,	Pittsburg, Pennsylvania.
*Dr. Leonard C. Mead,	Yankton, South Dakota.
Dr. Hugh B. Meredith,	Danville, Pennsylvania.
*Dr. Adolph Meyer,	New York City.
*Dr. Donald C. Meyers,	Toronto, Canada.
Dr. Harry W. Miller,	Taunton, Massachusetts.
*Dr. Charles K. Mills,	Philadelphia, Pennsylvania.
*Dr. Daniel T. Millspaugh,	Paterson, New Jersey.
Dr. H. Walter Mitchell,†	Hathorne, Massachusetts.
Dr. J. Nicholas Mitchell,	Philadelphia, Pennsylvania.
Dr. Thomas J. Mitchell,	Asylum, Mississippi.
Dr. Thomas J. Moher,	Brockville, Ontario, Canada.
*Dr. William H. Montgomery,†	Willard, New York.
Dr. G. H. Moody,	San Antonio, Texas.
Dr. Emma W. Mooers,	Waverley, Massachusetts.
Dr. Dwight S. Moore,	Jamestown, North Dakota.
Dr. Jason Morse,	Pontiac, Michigan.
Dr. William B. Moseley,†	Brooklyn, New York.
*Dr. J. Montgomery Mosher,	Albany, New York.
Dr. A. R. Moulton,	Philadelphia, Pennsylvania.
Dr. James D. Munson,	Traverse City. Michigan.
Dr. James F. Munson,†	Sonyea, New York.
Dr. P. L. Murphy,	Morganton, North Carolina.
Dr. B. Ross Nairn,†	Buffalo, New York.
Dr. Irwin H. Neff,	Pontiac, Michigan.
Dr. Ethan A. Nevin,†	Ogdensburg, New York.
Dr. John H. Nichols,	Tewksbury, Massachusetts.
Dr. Edward B. Nims,	Springfield, Massachusetts.
*Dr. Alfred I. Noble,	Kalamazoo, Michigan.
Dr. Henry S. Noble,	Middletown, Connecticut.
*Dr. Frank P. Norbury,	Jacksonville, Illinois.
Dr. Charles H. North,	Dannemora, New York.
Dr. Eben C. Norton,	Norwood, Massachusetts.
*Dr. William Noyes,	Mattapan, Massachusetts.
Dr. Henry B. Nunemaker,†	Philadelphia, Pennsylvania.
*Dr. John D. O'Brien,†	Massillon, Ohio.
Dr. George O'Hanlon,†	Kings Park, New York.
Dr. H. L. Orth,	Harrisburg, Pennsylvania.
Dr. Samuel T. Orton,†	Columbus, Ohio.
Dr. Herman Ostrander,	Kalamazoo, Michigan.
*Dr. Frederick H. Packard,†	Waverley, Massachusetts.
Dr. Flavius Packer,	New York City.
*Dr. Charles W. Page,	Hathorne, Massachusetts.
Dr. H. W. Page,	Baldwinsville, Massachusetts.

Dr. N. Emmons Paine,	West Newton, Massachusetts.
Dr. Harold L. Palmer,	Utica, New York.
Dr. Frederick W. Parsons,†	Poughkeepsie, New York.
Dr. Ralph L. Parsons,	Greenmont-on-Hudson, New York.
Dr. Stewart Paton,	Baltimore, Maryland.
Dr. Caroline S. Pease,†	Ogdensburg, New York.
*Dr. Middleton L. Perry,	Parsons, Kansas.
Dr. Frederick Peterson,	New York City.
Dr. Louis C. Pettit,†	New York City.
*Dr. Charles W. Pilgrim,	Poughkeepsie, New York.
*Dr. E. H. Pomeroy,	Monterey, Tennessee.
Dr. Carlyle A. Porteous,†	Montreal, Canada.
*Dr. Ezra B. Potter,	Rochester, New York.
*Dr. Theophilus O. Powell,	Milledgeville, Georgia.
Dr. John Preston,	Abilene, Texas.
Dr. Thomas P. Prout,†	Summit, New Jersey.
Dr. John Punton,	Kansas City, Missouri.
Dr. Emma Putnam,	Poughkeepsie, New York.
*Dr. James Jackson Putnam,	Boston, Massachusetts.
Dr. Hosea M. Quinby,	Worcester, Massachusetts.
Dr. J. M. Ratliff,	Dayton, Ohio.
*Dr. J. S. Redwine,	Lexington, Kentucky.
*Dr. W. W. Richardson,	Philadelphia, Pennsylvania.
*Dr. Charles E. Riggs,	St. Paul, Minnesota.
Dr. Frank W. Robertson,	New York City.
Dr. J. F. Robinson,	Nevada, Missouri.
Dr. Arthur C. Rogers,	Faribault, Minnesota.
Dr. Charles B. Rogers,†	Cincinnati, Ohio.
Dr. Joseph G. Rogers,	Logansport, Indiana.
Dr. Donald L. Ross,†	Sonyea, New York.
Dr. G. H. Rowe,	Boston, Massachusetts.
*Dr. John T. W. Rowe,	New York City.
Dr. Frederick D. Ruland,	Westport, Connecticut.
Dr. James Russell,	Hamilton, Ontario, Canada.
*Dr. William L. Russell,	Poughkeepsie, New York.
Dr. Edward Ryan,	Kingston, Canada.
Dr. Walter G. Ryon,†	Ogdensburg, New York.
*Dr. B. Sachs,	New York City.
Dr. Bigelow T. Sanborn,	Augusta, Maine.
Dr. H. Ernest Schmid,	White Plains, New York.
*Dr. Ernest V. Scribner,	Worcester, Massachusetts.
Dr. James T. Searcy,	Tuscaloosa, Alabama.
Dr. William Searl,	Cuyahoga Falls, Ohio.
Dr. Frederick Sefton,	Auburn, New York.
Dr. William T. Shanahan,†	Sonyea, New York.
Dr. Edward A. Sharp,	Katonah, New York.
*Dr. Arthur F. Shepherd,	Dayton, Ohio.
Dr. Jeanette H. Sherman,†	Norristown, Pennsylvania.
*Dr. David A. Shirres,†	Montreal, Canada.

*Dr. J. C. Simpson,	Washington, D. C.
Dr. George L. Sinclair,	Halifax, Nova Scotia.
Dr. A. L. Skoog,†	Pueblo, Colorado.
Dr. Clarence J. Slocum,†	Pleasantville, New York.
Dr. Edwin E. Smith,	South Wilton, Connecticut.
*Dr. George A. Smith,	Central Islip, New York.
Dr. Gilbert T. Smith,†	Danville, Pennsylvania.
Dr. S. E. Smith,	Richmond, Indiana.
Dr. Elbert M. Somers, Jr.,†	Ogdensburg, New York.
Dr. Elmer E. Southard,	Hathorne, Massachusetts.
Dr. Dwight S. Spellman,†	New York City.
Dr. George P. Sprague,	Lexington, Kentucky.
Dr. William P. Spratling,	Sonyea, New York.
Dr. M. J. Stack,†	Washington, D. C.
Dr. Charles E. Stanley,†	Middletown, Connecticut.
Dr. William G. Stearns,	Lake Geneva, Wisconsin.
*Dr. Henry R. Stedman,	Brookline, Massachusetts.
Dr. Frank T. Stevens,	Mt. Pleasant, Iowa.
Dr. Nolan Stewart,	Asylum, Mississippi.
Dr. H. Louis Stick,	Worcester, Massachusetts.
*Dr. George Stockton,	Columbus, Ohio.
Dr. William A. Stone,	Kalamazoo, Michigan.
Dr. Arthur Sweeney,	St. Paul, Minnesota.
Dr. Henry M. Swift,†	Hathorne, Massachusetts.
Dr. William E. Sylvester,	New York City.
Dr. Paul G. Taddiken,†	Brooklyn, New York.
Dr. Isaac M. Taylor,	Morganton, North Carolina.
Dr. Charles E. Thompson,	Gardner, Massachusetts.
Dr. J. L. Thompson,†	Columbia, South Carolina.
Dr. Whitefield N. Thompson,	Hartford, Connecticut.
Dr. Henry A. Tobey,	Toledo, Ohio.
Dr. H. A. Tomlinson,	St. Peter, Minnesota.
Dr. George H. Torney,	Utica, New York.
Dr. Theodore I. Townsend,	Utica, New York.
Dr. John S. Turner,	Terrell, Texas.
*Dr. George T. Tuttle,	Waverley, Massachusetts.
Dr. Edwin H. Van Deusen,	Kalamazoo, Michigan.
Dr. P. H. S. Vaughan,	Bangor, Maine.
Dr. George Villeneuve,	Longue Pointe, Quebec, Canada.
Dr. Arno C. Voight,†	Hawley, Pennsylvania.
*Dr. M. Nelson Voldeng,	Cherokee, Iowa.
*Dr. J. Percy Wade,	Catonsville, Maryland.
*Dr. Charles G. Wagner,	Binghamton, New York.
Dr. Irving L. Walker,†	Rochester, New York.
Dr. Lewis M. Walker,†	Harding, Massachusetts.
Dr. John W. Ward,	Trenton, New Jersey.
Dr. Henry M. Weeks,	Skillman, New Jersey.
Dr. G. O. Welch,	Fergus Falls, Minnesota.
*Dr. Lowell F. Wentworth,	Boston, Massachusetts.

Dr. Calvin B. West,†	Central Islip, New York.
Dr. J. W. Wherry,†	Dansville, New York.
Dr. J. M. Whitaker,†	Milledgeville, Georgia.
Dr. Grace E. White,†	Philadelphia, Pennsylvania.
Dr. M. J. White,	Wauwatosa, Wisconsin.
Dr. Whitman V. White,	New York City.
*Dr. William A. White,	Washington, D. C.
Dr. Franklin S. Wilcox,†	Fergus Falls, Minnesota.
Dr. Sidney D. Wilgus,	New York City.
*Dr. Berthold A. Williams,	College Hill, Ohio.
Dr. G. H. Williams,†	Columbus, Ohio.
Dr. Alonzo P. Williamson,	Patton, California.
Dr. O. J. Wilsey,	Amityville, New York.
Dr. Uranus O. Wingate,	Milwaukee, Wisconsin.
Dr. Robert P. Winterode,†	Sykesville, Maryland.
Dr. Peter M. Wise,	New York City.
Dr. M. E. Witte,	Clarinda, Iowa.
Dr. Mary M. Wolfe,	Norristown, Pennsylvania.
Dr. Charles E. Woodbury,	Foxboro, Massachusetts.
*Dr. Robert C. Woodman,†	Middletown, New York.
Dr. C. R. Woodson,	St. Joseph, Missouri.
Dr. Samuel Worcester,	Stamford, Connecticut.
*Dr. Hubert Work,	Pueblo, Colorado.
Dr. B. M. Worsham,	Austin, Texas.
Dr. W. E. Wright,†	Harrisburg, Pennsylvania.
Dr. Malcolm H. Yeaman,	Lakeville, Kentucky.
Dr. David Young,	Selkirk, Manitoba, Canada.
Dr. George S. Youngling,	New York City.
Dr. George A. Zeller,	Peoria, Illinois.

HONORARY MEMBERS.

Dr. Henry M. Bannister,	Evanston, Illinois.
*James M. Buckley, D.D.,	Morristown, New Jersey.
Dr. Daniel Clark,	Toronto, Canada.
Dr. Thomas S. Clouston, F.R.C.P., F.R.S.E.,	Edinburgh, Scotland.
Dr. Charles F. Folsom,	Boston, Massachusetts.
G. Stanley Hall, Ph.D.,	Worcester, Massachusetts.
*Dr. Henry Hun,	Albany, New York.
Dr. William P. Letchworth,	Glen Iris, New York.
Dr. Wesley Mills,	Montreal, Canada.
*Dr. S. Weir Mitchell,	Philadelphia, Pennsylvania.
Dr. Jules Morel,	Mons, Belgium.
Dr. A. M. Motet,	Paris, France.
Dr. Victor Parant,	Toulouse, France.
Dr. Emmanuel Régis,	Bordeaux, France.
Dr. Antoine Ritti,	Charenton, France
Dr. James Rutherford, F.R.C.P., (Edin.), F.F.P.S.,	Dumfries, Scotland.

Dr. Réné Semelaigne,	Paris, France.
Dr. Stephen Smith,	New York City.
Dr. James B. Spence, R.U.I., M.Ch.,	Burntwood, England.
Dr. A. Tamburini,	Reggio-Emilia, Italy.
Dr. Edouard Toulouse,	Villejuif, France.
Dr. Alexander R. Urquhart, F.R.C.P.E.,	Perth, Scotland.
Dr. D. R. Wallace,	Waco, Texas.
Dr. David Yellowlees, F.F.P.S., LL.D.,	Glasgow, Scotland.

AMERICAN ASSOCIATION OF PATHOLOGISTS AND BACTERIOLOGISTS.

Organized 1900.

*Dr. A. C. Abbott,	Philadelphia, Pennsylvania.
Dr. J. G. Adami,	Montreal, Canada.
*Dr. Isaac Adler,	New York City.
Dr. Bailey K. Ashford,	Washington, D. C.
Dr. F. R. Bailey,	New York City.
Dr. A. W. Balch, U. S. N.,	Caracas, Philippine Islands.
Dr. Leon K. Baldauf,	Albany, New York.
*Dr. Edward R. Baldwin,	Saranac Lake, New York.
Dr. F. A. Baldwin,	Dallas, Texas.
*Dr. L. F. Barker,	Baltimore, Maryland.
Dr. Charles J. Bartlett,	New Haven, Connecticut.
Dr. Peter Bassoe,	Chicago, Illinois.
*Dr. Silas P. Beebe,	New York City.
*Dr. Charles A. Bentz,	Buffalo, New York.
Dr. David H. Bergey,	Philadelphia, Pennsylvania.
Dr. H. G. Beyer,	Portland, Maine.
Dr. George P. Biggs,	New York City.
*Dr. Frank Billings,	Chicago, Illinois.
*Dr. Joseph C. Bloodgood,	Baltimore, Maryland.
*Dr. George Blumer,	New Haven, Connecticut.
Dr. John T. Bowen,	Boston, Massachusetts.
Dr. Harlow Brooks,	New York City.
Dr. A. A. Bruere,	Montreal, Canada.
*Dr. C. H. Bunting,	Charlottesville, Virginia.
Dr. S. H. Burnett,	Ithaca, New York.
*Dr. H. L. Burrell,	Boston, Massachusetts.
Dr. B. H. Buxton,	New York City.
Dr. H. W. Carey,	Troy, New York.
Dr. James Carroll,	Washington, D. C.
Dr. Timothy M. Cheesman,	Garrison-on-Hudson, New York.
*Dr. H. A. Christian,	Boston, Massachusetts.

Dr. R. I. Cole,	Baltimore, Maryland.
Dr. Claribel Cone,	Baltimore, Maryland.
*Dr. W. M. Late Coplin,	Philadelphia, Pennsylvania.
Dr. W. T. Councilman,	Boston, Massachusetts.
*Dr. D. M. Cowie,	Ann Arbor, Michigan.
*Dr. George W. Crile,	Cleveland, Ohio.
*Dr. Thomas S. Cullen,	Baltimore, Maryland.
*Dr. Harvey Cushing,	Baltimore, Maryland.
Dr. Eugene A. Darling,	Cambridge, Massachusetts.
Dr. David J. Davis,	Chicago, Illinois.
*Dr. George Dock,	Ann Arbor, Michigan.
*Dr. Edward K. Dunham,	New York City.
*Dr. Charles W. Duval,	Montreal, Canada.
*Dr. D. L. Edsall,	Philadelphia, Pennsylvania.
*Dr. W. J. Esler,	New York City.
*Dr. H. C. Ernst,	Boston, Massachusetts.
Dr. W. A. Evans,	Chicago, Illinois.
*Dr. James Ewing,	New York City.
*Dr. Cyrus W. Field,	New York City.
Dr. C. Fisch,	St. Louis, Missouri.
*Dr. R. H. Fitz,	Boston, Massachusetts.
Dr. Simon Flexner,	New York City.
Dr. Thomas Flournoy,	New York City.
*Dr. W. W. Ford,	Baltimore, Maryland.
Dr. G. C. Freeborn,	New York City.
Dr. Langdon Frothingham,	Boston, Massachusetts.
*Dr. Frank T. Fulton,	Providence, Rhode Island.
*Dr. Frederick P. Gay,	Hathorne, Massachusetts.
*Dr. Harvey R. Gaylord,	Buffalo, New York.
Dr. Nathaniel Gildersleeve,	Philadelphia, Pennsylvania.
*Dr. S. H. Gilliland,	Marietta, Pennsylvania.
Prof. Frederick P. Gorham,	Providence, Rhode Island.
*Dr. William S. Halsted,	Baltimore, Maryland.
Dr. Carl A. Hamann,	Cleveland, Ohio.
*Dr. S. McC. Hamill,	Philadelphia, Pennsylvania.
Dr. Alice Hamilton,	Chicago, Illinois.
Dr. Charles Harrington,	Boston, Massachusetts.
Dr. Norman McL. Harris,	Chicago, Illinois.
*Dr. Thomas Wood Hastings,	New York City.
*Dr. L. Hektoen,	Chicago, Illinois.
*Dr. James B. Herrick,	Chicago, Illinois.
Dr. Maximilian Herzog,	Chicago, Illinois.
Dr. H. W. Hill,	Minneapolis, Minnesota.
Dr. Philip Hanson Hiss,	New York City.
Dr. Eugene Hodenpyl,	New York City.
Dr. Samuel A. Hopkins,	Boston, Massachusetts.
Dr. Campbell P. Howard,	Montreal, Canada.
Dr. William T. Howard, Jr.,	Cleveland, Ohio.
Dr. G. Carl Huber,	Ann Arbor, Michigan.

Prof. E. O. Jordan,	Chicago, Illinois.
*Dr. A. O. J. Kelly,	Philadelphia, Pennsylvania.
*Dr. H. M. King,	Liberty, New York.
*Dr. Howard N. Kingsford,	Hanover, New Hampshire.
Dr. Hugh M. Kinghorn,	New York City.
*Dr. J. J. Kinyoun,	Glen Olden, Pennsylvania.
*Oskar Klotz, M.B.,	Montreal, Canada.
Dr. Preston Kyes,	Chicago, Illinois.
Dr. A. T. Laird,	Albany, New York.
*Dr. G. A. Langmann,	New York City.
Dr. Timothy Leary,	Boston, Massachusetts.
*Dr. E. R. LeCount,	Chicago, Illinois.
*Dr. Isaac Levin,	New York City.
*Dr. Emanuel Libman,	New York City.
*Dr. Leo Loeb,	Philadelphia, Pennsylvania.
*Dr. W. T. Longcope,	Philadelphia, Pennsylvania.
Dr. Irving P. Lyon,	Buffalo, New York.
*Dr. W. G. MacCallum,	Baltimore, Maryland.
*Dr. John J. Mackenzie,	Toronto, Ontario, Canada.
Dr. John H. McCollom,	Boston, Massachusetts.
*Dr. Guthrie McConnell,	St. Louis, Missouri.
Dr. Ellice McDonald,	New York City.
Dr. Joseph McFarland,	Philadelphia, Pennsylvania.
Dr. Walter McN. Miller,	Columbia, Missouri.
*Dr. F. B. Mallory,	Boston, Massachusetts.
*Dr. F. S. Mandlebaum,	New York City.
*Dr. W. H. Manwaring,	Bloomington, Indiana.
Dr. Charles F. Martin,	Montreal, Canada.
*Dr. S. J. Meltzer,	New York City.
*Dr. Adolf Meyer,	New York City.
Dr. Harris Moak,	Brooklyn, New York.
Dr. Veranus A. Moore,	Ithaca, New York.
*Dr. Roger S. Morris,	Baltimore, Maryland.
*Dr. J. H. Musser,	Philadelphia, Pennsylvania.
Dr. E. H. Nichols,	Boston, Massachusetts.
*Dr. Hideyo Noguchi,	New York City.
Dr. Charles Norris,	New York City.
*Dr. F. G. Novy,	Ann Arbor, Michigan.
Dr. A. P. Ohlmacher,	Detroit, Michigan.
Dr. William Ophüls,	San Francisco, California.
*Dr. Eugene L. Opie,	New York City.
Dr. Calvin G. Page,	Boston, Massachusetts.
Dr. Alwin Pappenheimer,	New York City.
*Dr. William Hallock Park,	New York City.
*Dr. R. M. Pearce, Jr.,	Albany, New York.
*Dr. Herbert D. Pease,	Albany, New York.
*Dr. Roger G. Perkins,	Cleveland, Ohio.
Dr. Sigmund Pollitzer,	New York City.
*Dr. J. H. Pratt,	Boston, Massachusetts.

Dr. T. Mitchell Prudden,	New York City.
*Dr. Mazyck P. Ravenel,	Philadelphia, Pennsylvania.
*Dr. Mark W. Richardson,	Boston, Massachusetts.
Dr. Oscar Richardson,	Boston, Massachusetts.
Dr. Howard T. Ricketts,	Chicago, Illinois.
*Dr. David Riesman,	Philadelphia, Pennsylvania.
Dr. William H. Robey, Jr.,	Boston, Massachusetts.
*Dr. Milton J. Rosenau,	Washington, D. C.
Dr. G. F. Ruediger,	Chicago, Illinois.
Dr. G. Y. Rusk,	New York City.
Dr. Nelson G. Russel,	Buffalo, New York.
*Dr. Joseph Sailer,	Philadelphia, Pennsylvania.
Dr. Max G. Schlapp,	New York City.
Dr. Otto H. Schultz,	New York City.
Dr. Fritz Schwyzer,	New York City.
Dr. A. J. Smith,	Philadelphia, Pennsylvania.
*Dr. Theobald Smith,	Boston, Massachusetts.
Dr. Frederic E. Sondern,	New York City.
Dr. E. E. Southard,	Hathorne, Massachusetts.
*Dr. William G. Spiller,	Philadelphia, Pennsylvania.
Dr. E. MacD. Stanton,	Chicago, Illinois.
*Dr. John D. Steele,	Philadelphia, Pennsylvania.
*Dr. Walter R. Steiner,	Hartford, Connecticut.
Dr. Edna Steinhardt,	New York City.
*Dr. Alfred Stengel,	Philadelphia, Pennsylvania.
Dr. J. E. Sweet,	Philadelphia, Pennsylvania.
Dr. E. W. Taylor,	Boston, Massachusetts.
Dr. Benjamin T. Terry,	New York City.
Dr. A. E. Thayer,	Galveston, Texas.
*Dr. William Sidney Thayer,	Baltimore, Maryland.
*Dr. J. J. Thomas,	Boston, Massachusetts.
*Dr. R. L. Thompson,	St. Louis, Missouri.
*Dr. John C. Torrey,	New York City.
*Dr. Edward L. Trudeau,	Saranac Lake, New York.
Dr. Joshua M. Van Cott,	Brooklyn, New York.
Dr. Roy McL. Van Wart,	New Orleans, Louisiana.
*Dr. Victor C. Vaughan,	Ann Arbor, Michigan.
Dr. Victor C. Vaughan, Jr.,	Detroit, Michigan.
*Dr. F. H. Verhoeff,	Boston, Massachusetts.
Dr. Swale Vincent,	Winnipeg, Canada.
*Dr. Augustus Wadsworth,	New York City.
*Dr. J. C. Warren,	Boston, Massachusetts.
*Dr. Aldred Scott Warthin,	Ann Arbor, Michigan.
*Dr. George H. Weaver,	Chicago, Illinois.
Dr. J. D. Weiss,	New Orleans, Louisiana.
*Dr. William H. Welch,	Baltimore, Maryland.
Dr. H. G. Wells,	Chicago, Illinois.
Dr. Grover W. Wende,	Buffalo, New York.
*Dr. F. F. Wesbrook,	Minneapolis, Minnesota.

Dr. George Hoyt Whipple,	Baltimore, Maryland.
Dr. Charles J. White,	Boston, Massachusetts.
Dr. C. Y. White,	Philadelphia, Pennsylvania.
*Dr. F. N. Whittier,	Brunswick, Maine.
Dr. A. W. Williams,	New York City.
*Dr. Herbert U. Williams,	Buffalo, New York.
*Dr. J. Whitridge Williams,	Baltimore, Maryland.
Dr. W. W. Williams,	Cleveland, Ohio.
*Dr. R. N. Willson,	Philadelphia, Pennsylvania.
Dr. Charles K. Winne, Jr.,	Albany, New York.
*Dr. S. B. Wolbach,	Boston, Massachusetts.
Dr. Martha Wollstein,	New York City.
*Dr. Francis C. Wood,	New York City.
Dr. Jonathan Wright,	New York City.
Dr. J. L. Yates,	Milwaukee, Wisconsin.
Dr. F. Robert Zeit,	Chicago, Illinois.

The following were present as

VISITORS

to various of the component Associations.

Dr. Maude E. Abbott,	Montreal, Canada.
Dr. J. L. Addison,	St. George, Ont., Canada.
Dr. A. F. Alexander,	Paterson, New Jersey.
Dr. E. H. Arnold,	New Haven, Connecticut.
Dr. Astley P. C. Ashhurst,	Philadelphia, Pennsylvania.
Dr. Arthur E. Austin,	Boston, Massachusetts.
Dr. O. D. Ball,	Albany, New York.
Dr. Charles W. Banks,	East Orange, New Jersey.
Dr. P. Henry Barbat,	San Francisco, California.
Dr. J. Hammond Bradshaw,	Orange, New Jersey.
Dr. D. T. Bowden,	Paterson, New Jersey.
Dr. Charles E. Briggs,	Cleveland, Ohio.
Dr. H. H. Briggs,	Asheville, North Carolina.
Dr. Herbert A. Bruce,	Toronto, Canada.
Dr. W. Evans Bruner,	Cleveland, Ohio.
Dr. Irving Howard Cameron,	Toronto, Canada.
Dr. Henry S. Carmany,	Philadelphia, Pennsylvania.
Dr. Clarence E. Case,	Ashtabula, Ohio.
Dr. Charles W. Chapin,	New York City.
Dr. O. E. Closson,	Marietta, Pennsylvania.
Dr. G. H. A. Clowes,	Buffalo, New York.
Dr. David D. Custer,	Philadelphia, Pennsylvania.
Dr. James B. Eagleson,	Seattle, Washington.
Dr. Frank B. Earle,	Chicago, Illinois.

Dr. E. M. von Eberts,	Montreal, Canada.
Dr. P. Y. Eisenberg,	Morristown, Pennsylvania.
Dr. Kendall Emerson,	Worcester, Massachusetts.
Dr. Albert A. Epstein,	New York City.
Dr. George H. Evans,	San Francisco, California.
Dr. W. J. Ferguson,	Sedalia, Missouri.
Dr. Henry O. Feiss,	Cleveland, Ohio.
Dr. Ralph R. Fitch,	Rochester, New York.
Dr. R. D. Francis,	Montclair, New Jersey.
Dr. W. J. Frick,	Kansas City, Missouri.
Dr. Otto C. Gaub,	Pittsburg, Pennsylvania.
Dr. A. E. Garrow,	Montreal, Canada.
Dr. W. Harry Glenny,	Buffalo, New York.
Dr. Robert B. Greenough,	Boston, Massachusetts.
Dr. Albert E. Halstead,	Chicago, Illinois.
Dr. S. W. Hamilton,	New York City.
Dr. Thomas V. Hammond,	Washington, D. C.
Dr. R. B. Harkness,	Houghton, Michigan.
Dr. Charles G. Harmer,	Toronto, Canada.
Dr. T. W. Harvey,	Baltimore, Maryland.
Dr. Saint J. Hunkin,	San Francisco, California.
Dr. J. Alexander Hutchison,	Montreal, Canada.
Dr. J. H. Jacobson,	Toledo, Ohio.
Mr. Robert Jones,	Liverpool, England.
Dr. Joseph V. Kelly,	Philadelphia, Pennsylvania.
Dr. H. Hyland Kerr,	Washington, D. C.
Dr. James Kerr,	Washington, D. C.
Dr. John B. Knapp,	New York City.
Dr. F. E. Lawlor,	Halifax, Nova Scotia.
Dr. Prescott LeBreton,	Buffalo, New York.
Dr. H. T. Machell,	Toronto, Canada.
Dr. Franklin H. Martin,	Chicago, Illinois.
Dr. A. F. McBride,	Paterson, New Jersey.
Dr. John C. McCoy,	Paterson, New Jersey.
Dr. John McCrae,	Montreal, Canada.
Dr. Alexias McGlannan,	Baltimore, Maryland.
Dr. Paul A. McIlherney,	New Orleans, Louisiana.
Dr. Handford McKee,	Montreal, Canada.
Dr. Charles H. Miner,	Wilkesbarre, Pennsylvania.
Dr. William J. Mixter,	Boston, Massachusetts.
Dr. James D. Morgan,	Washington, D. C.
Dr. W. H. Moseley,	Detroit, Michigan.
Dr. Stewart B. Muncaster,	Washington, D. C.
Dr. Charles Ogilvey,	New York City.
Dr. Ingersoll Olmsted,	Hamilton, Ontario, Canada.
Dr. Richard F. O'Neil,	Boston, Massachusetts.
Dr. Walter R. Parker,	Ann Arbor, Michigan.
Dr. George H. Peck,	New Rochelle, New York.
Dr. William C. Peters,	Bangor, Maine.

Dr. H. P. Plummer,	Rochester, Minnesota.
Dr. Newton A. Powell,	Toronto, Canada.
Dr. Henry D. Prescott,	New Bedford, Massachusetts.
Dr. A. Primrose,	Toronto, Canada.
Dr. Ralph T. Richards,	Salt Lake City, Utah.
Dr. Percy W. Roberts,	New York City.
Dr. Lewis W. Rose,	Rochester, New York.
Dr. Arthur S. Ruland,	Syracuse, New York.
Dr. Grant Selfridge,	San Francisco, California.
Dr. Edward R. Sill,	Oakland, California.
Dr. J. O. Skinner,	Washington, D. C.
Dr. Z. T. Sowers,	Washington, D. C.
Dr. William B. Stephens,	San Francisco, California.
Dr. W. S. Steward,	Wilkesbarre, Pennsylvania.
Dr. Paul R. Swett,	Hartford, Connecticut.
Dr. J. H. Tanquary,	St. Louis, Missouri.
Dr. Albert E. Taussig,	St. Louis, Missouri.
Dr. Charles E. Thomson,	Scranton, Pennsylvania.
Dr. Martha Tracy,	Plainfield, New Jersey.
Dr. Harry R. Trick,	Buffalo, New York.
Dr. P. E. Truesdale,	Fall River, Massachusetts.
Dr. W. G. Turner,	Montreal, Canada.
Dr. Edgar A. Van der Veer,	Albany, New York.
Dr. R. E. Walker,	Ann Arbor, Michigan.
Dr. John Warren,	Boston, Massachusetts.
Dr. Richard M. Weil,	New York City.
Dr. Charles I. White,	Washington, D. C.
Dr. Irving D. Williams,	Otisville, New York.

RECAPITULATION.

	Members.			
	Active and Associate.	Corresponding	Honorary.	Present
American Ophthalmological Society	176	..	1	87
American Otological Society	136	..	8	71
American Neurological Association	107	20	11	71
American Gynecological Society	99	..	24	74
American Dermatological Association*..	57	..	10	6
American Laryngological Association ..	85	29	1	61
American Surgical Association	132	..	18	100
American Climatological Association ..	150	10	8	97
Association of American Physicians	142	..	25	122
American Association of Genito-Urinary Surgeons	50	9	5	35
American Orthopedic Association	62	21	6	51
American Physiological Society	137	..	6	42
American Pediatric Society	57	..	8	39
American Medico-Psychological Association	429	..	24	128
American Association of Pathologists and Bacteriologists	188	..	..	94
	2007	89	155	1078
Total membership of the Congress		2251		
Guests and Visitors				105
Total attendance				1183

*Held no meeting.

THE HISTORICAL DEVELOPMENT AND RELATIVE VALUE OF LABORATORY AND CLINICAL METHODS IN DIAGNOSIS.

THE EVOLUTION OF THE IDEA OF EXPERIMENT IN MEDICINE.

BY WILLIAM OSLER, M.D.,

Regius Professor of Medicine, Oxford.

That man can interrogate as well as observe nature was a lesson slowly learned in his evolution. Of the two methods by which he can do this, the mathematical and the experimental, both have been equally fruitful—by the one he has gauged the starry heights and harnessed the cosmic forces to his will; by the other he has solved many of the problems of life and lightened many of the burdens of humanity.

Of the beginnings of experimental science we have no accurate knowledge, but the men who invented the gnomon and predicted ellipses on the plains of Mesopotamia, that mysterious Sumerian race, laid its foundation, and their knowledge became a powerful instrument in the hands of the Ionian nature-philosopher, of whom Thales is the venerable head. Great thinkers, and with magical instinct, these old Greeks had anticipations of nearly every modern discovery, but we have details of one really fundamental experiment, and that was when Pythagoras discovered the dependence of the pitch of sound on the length of the vibrating chord. "The monochord which he used for his experiments on the physics of sound consisted of a string stretched over a resounding board with a movable bridge, by means of which it was possible to divide the strings into different lengths, and thus to produce the various high and low notes on one and the same string."

Had the Greeks added to their genius for brilliant generalization and careful observation the capacity to design and carry out experiments, the history of European thought would have been very different, but neither Plato nor Aristotle had any conception of the value of experiment as an instrument in the progress of knowledge. Hippocrates appreciated the *fact* as an essential element more highly than any of his contemporaries, and though he had theoretical conceptions of disease, yet to him facts, as obtained by observation,

were the Alpha and Omega of the art. To seek for facts by altering the conditions which nature presented did not occur to him, and yet it must over and over again have happened in the treatment of fractures that he had to try new methods and devise new procedures; and to shake a man with fluid in his chest to get what we call the Hippocratic succession was a noteworthy clinical experiment.

With the great masters of the Alexandrine school, time has dealt hardly. Had we their complete works we should find that they were not only the first great anatomists, but that to clinical acumen of an extraordinary quality was added a zeal for experimentation, which, if Celsus is to be credited, led to the vivisection of criminals. Like his teacher, Praxagoras, Herophilus made the state of the pulse the measure of the strength of the constitution, and timed it with a water-clock, but both to him and to Erasistratos we owe more anatomical and clinical than physiological observations. They extended the Hippocratic art of observation to the dead house and were the first to see the value of morbid anatomy.

Among the dogmatics and empirics arose the science of toxicology and the study of poisons and their antidotes led to an active cultivation of this side of experimental medicine. Not only animals, but criminals were used to test the effects of poisons, and the art reached its climax in antiquity in the royal student, Mithradates, who could to-day talk intelligently with Ehrlich about immunity, in which he had grasped two fundamental facts—the conference of protection by gradually increasing dosage of the poison, and the use of the blood of animals rendered immune. What an interested visitor he would be to-day in a diphtheria antitoxine laboratory, in which he could compare the methods in use in the horse with those which he employed for his ducks. The name of the great king was embalmed in the profession for nearly two thousand years in the universal antidote, Mithradaticon, with 50 to 60 ingredients.

One man alone among the ancients could walk into the physiological laboratories to-day and feel at home. Claudius Galen was not a greater observer than Hippocrates, nor perhaps a greater anatomist than Herophilus or Erasistratos, nor was he so brilliant and daring a surgeon as Antyllus, but he stands out in our history as the first physician who had a clear conception of medicine as a science. He recognized that valuable as observation was, the bare fact was not science, but only the preliminary, the first step towards that organized grouping of facts from which principles and laws could be derived. Not structure alone, with which anatomy is satisfied, but function,

the use of the part, was to be ascertained; not the symptom of the disease alone was to be investigated, but the cause, how it arose. In brilliant experiments upon the heart and arteries he almost demonstrated the circulation of the blood; in his work on the nervous system he anticipated the discoveries of Bell and Marshall Hall, and he laid the foundations for our knowledge of the physiology of the brain and spinal cord.

For long centuries the anatomy, the physiology, the surgery and the practice of Galen dominated the schools—Byzantine, Arabic, Salernitan all bowed in humble, slavish submission to his authority, taking from him everything but his spirit, everything but the new instrument which he had put into the hands of the profession. Valuable observations were added, and the middle ages were perhaps not as barren as we are taught to believe, but there was nowhere any attempt to take up the experimental work which had so auspiciously begun. Still a brilliant torch was lighted by the Arabians from the lamps of Aristotle and Galen, and in the first Greek Renaissance between the 8th and the 11th centuries the profession reached, among them, a position of dignity and importance to which it is hard to find a parallel in its history. The foundations of modern chemistry were laid, and many new drugs were added to the pharmacopeia, but though Rhazes was known as the experimentator, neither in his writings nor in those of other men of the Arabian school do we find any solid contribution to anatomy or physiology. Nor did the second Greek Renaissance, at the end of the 15th century, at once bring relief. Men were too busy scraping off the Arabian tarnish from the pure gold of Greek medicine, and correcting the mistakes of Galen in anatomy, to bother about disturbing his physiology or pathology. Here and there among the great anatomists of the period we read of an experiment, but it was the art of observation, the art of Hippocrates, not the science of Galen, not the carefully devised experiment to determine function, that characterized their work. There was indeed every reason why men should have been content with the physiology and pathology of that day, as from a theoretical standpoint it was excellent. The doctrine of the four humors and of the natural, animal and vital spirit afforded a ready explanation for the symptoms of all diseases, and the practice of the day was admirably adapted to the theories. There was no thought of, no desire for change. But the revival of learning awakened in men at first a suspicion and at last a conviction that the ancients had left something which could be reached by

independent research, and gradually the paralytic-like torpor passed away. Independent spirits like Paracelsus defied all academic traditions and threw the doctrines of Galen and Avicenna to the winds. But throughout the 16th century there was very little experimental work in medicine, and though Paracelsus and his followers made researches in chemistry and improved the art of pharmacy, it was still the age of the eye and the devising hand, as an instrument of the mind had not yet been called into requisition. Astronomy, which had given science the start originally, again gave it the needed stimulus, and the inventions and discoveries of Copernicus, Kepler and Galileo revived mechanical invention and experimentation in medicine. At our second Congress, you remember how graphically Dr. Weir Mitchell told the story of instrumental precision in medicine. An important part of this address was taken up with an account of Sanctorius and his construction of the thermometer and the pulsilogum of Galileo and the balance. Nothing can be added to Dr. Mitchell's account of the experimental and clinical work of Sanctorius; indeed it is the only complete account in English, and, as he pointed out, in the investigations of this Italian physician we have the beginnings of our clinical and experimental work in the physics of the circulation and respiration and in metabolism. The memory of the great investigator has not been helped by the English edition of the aphorisms, which is a feeble work, with the picture of the author in his dietetic balance, and we must turn to the originals or to Dr. Mitchell's address to appreciate that with him the science of medicine takes a new start in aiding observation with instruments of precision.

Contemporaneously with Sanctorius, Harvey was quietly working at the problem of the circulation of the blood and perfecting through a series of years his remarkable demonstrations. It is interesting that his method of work was a new departure, and showed a new spirit. We have to go back to Galen and his hemi-section of the spinal cord or to his division of the recurrent laryngial nerve for similar studies on function deliberately planned and deliberately carried out by way of experiment.

Neither Sanctorius nor Harvey had the immediate influence upon their contemporaries which the novel and stimulating character of their work justified. Harvey's great countryman, Bacon, although he lost his life in making a cold storage experiment, did not really appreciate the enormous importance of experimental science. It was a philosopher of another kidney, René Descartes, who did more

than anyone to help men to realize the value of the better way which Harvey had pointed out. That the beginning of wisdom was in doubt, not in authority, was a novel doctrine in the world, but he was no arm-chair philosopher, and his strong advocacy and practice of experimentation had a profound influence in directing man to *la nouvelle methode*. He brought the human body, the earthly machine, as he calls it, into the sphere of mechanics and physics, and he wrote the first text-book of physiology, *De l'homme*. Locke, too, became the spokesman of the new questioning spirit, and before the close of the 17th century experimental research became all the mode, and Evelyn tells us that the Merry Monarch had a laboratory and knew many of the empirical medicines. Lower, Hooke and Hales were probably more influenced by Descartes than by Harvey, and they made noteworthy contributions to experimental physiology in England. Borelli brought to the study of the action of muscles a profound knowledge of physics and mathematics and really founded the iatro-mathematical school.

Modern experimental chemistry had its origin in the alchemy of the Arabians, and we can trace its progress through Basil, Valentine, Paracelsus, van Helmont, Boyle and Sylvius. Mayow, in a brilliant series of researches, solved the problem of combustion, and demonstrated the essential part played in respiration by the nitro-aerial part (the oxygen as we now know it) of the air. * * * *

In the latter half of the eighteenth century experimental science received an enormous impetus through the work of two men. Spallanzani demonstrated the chemical nature of the digestive process, and from him dates our modern science of reproduction. In John Hunter there met a rare triple combination—powers of observation which in width and acuteness have rarely been equalled, a perfect genius for experimentation, and such a philosophic grasp of the problems of disease as enabled him to raise pathology into a science. To his student and friend, Edward Jenner, we owe the great experiments from which date our practical work on immunity.

In the beginning of the last century the art of observation, the great instrument of Hippocrates, found the full development in the hands of the French school, by which the diagnosis of disease was put upon a sound basis, while in the forties the keen eyes of Virchow revealed to us for the first time the true seats of disease. The work of Bichat, of Laennec, of Louis, and the monumental studies of the great Berlin pathologist, illustrated what the rigid inductive method

could accomplish by minds freed from all dominating theories under the control of the law of facts, and no longer trafficking in hypotheses. But the century was well advanced before the profession realized the full worth of the method of Galen, of Harvey and of Hunter. How slow we were to appreciate this is illustrated by what Helmholtz tells of the celebrated professor of physiology in the fifties, who, asked to see an experiment in optics, said, "A physiologist has nothing to do with experiments, though they might be well enough for a physicist!" The last half of the century may be called the era of experimental medicine, and the truly prodigious results have been along three lines—the discovery of the functions of organs, the discovery of the causes of disease and the discovery of new methods of treatment. A single generation, indeed, has witnessed a complete readjustment of our outlook on physiology, pathology and practice, and all this has come from a recognition that experiment is the very basis of science. Much has been done, but when we look ahead at what remains we see that only a beginning has been made, and there is not a department in practical medicine in which there are not innumerable problems of the first rank awaiting solution. And every new advance in physiology demands from the pathologist and clinician a change of view and a reopening of old questions believed to be settled. Such work as that of Starling's on the correlation of secretions has already opened a new field for observation and research. With the advances in physics and chemistry it becomes increasingly difficult to find men with the training necessary to attack intelligently these complicated problems. We need in association with all our large hospitals clinical laboratories in charge of men who will be selected to do this work by directors who are themselves thinkers as well as workers. For often all the essence of a successful experiment is the thought that precedes it. *Deviner avant de démonstrator* must be the motto of every experimental investigator. We must have clinicians who keep in close touch with physiology, pathology and chemistry, and who are prepared to transfer to the wards through proper channels the knowledge of the laboratory. The organized medical clinic is a clearing-house for the scientific traders who are doing business in all parts of the body corporate, and the application of new facts to medicine must come through it, or through that small but happily increasing group of men who find time amid the daily cares of practice. One thing is certain; we clinicians must go to the physiologists, the pathologists and the chemists—they no longer come to us. To our

irreparable loss these sciences have become so complicated and demand such life-long devotion that no longer do physiologists, like Hunter, Bowman and Lister, become surgeons, chemists, like Prout and Bence-Jones, clinicians, and saddest of all, the chair of pathology is no longer a stepping-stone to the chair of medicine. The new conditions must be met if progress is to be maintained. In every country there will be found strong men, like Weir Mitchell, Mackenzie of Barnley, and Meltzer and Christian Herter, who find it possible to combine experimental work with practice, but we must recognize the pressing need of organization if internal medicine is to keep in close touch with the rapid advancement of the sciences. A glance at the program of the Association of American Physicians' meeting indicates the dominance of experiment at the present day.

To each one of us life is an experiment in Nature's laboratory, and she tests and tries us in a thousand ways, using and improving us if we serve her turn, ruthlessly dispensing with us if we do not. Disease is an experiment, and the earthly machine is a culture medium, a test tube and a retort—the external agents, the medium and the reaction constituting the factors. We constantly experiment with ourselves in food and drink, and the expression so often on our lips, "Does it agree with you?" signifies how tentative are many of our daily actions. The treatment of disease has always been experimental, and started indeed in those haphazard endeavors of friends and relatives to try something to help the sufferer. Each dose of medicine given is an experiment, as it is impossible to predict in every instance what the result may be. Thousands of five-grain doses of iodide of potassium may be given without ill effect, and then conditions are met with in which the patient reacts with an outbreak of purpura, or a fatal result may follow. A deviation from what we had regarded as a settled rule, a break in a sequence thought to be invariable, emphasizes the impossibility of framing general rules for the body of the same rigid applicability as in physics and mechanics. The limits of justifiable experimentation upon our fellow creatures are well and clearly defined. The final test of every new procedure, medical or surgical, must be made on man, but never before it has been tried on animals. There are those who look upon this as unlawful, but in no other way is progress possible, nor could we have had many of our most useful but very powerful drugs if animal experimentation had been forbidden. For man absolute safety and full consent are the conditions which

make such tests allowable. We have no right to use patients entrusted to our care for the purpose of experimentation unless direct benefit to the individual is likely to follow. Once this limit is transgressed, the sacred cord which binds physician and patient snaps instantly. Risk to the individual may be taken with his consent and full knowledge of the circumstances, as has been done in scores of cases, and we cannot honor too highly the bravery of such men as the soldiers who voluntarily submitted to the experiments on yellow fever in Cuba under the direction of Reed and Carroll. The history of our profession is starred with the heroism of its members who have sacrificed health and sometimes life itself in endeavors to benefit their fellow creatures. Enthusiasm for science has, in a few instances, led to regrettable transgressions of the rule I have mentioned, but these are mere specks which in no wise blur the brightness of the picture—one of the brightest in the history of human effort—which portrays the incalculable benefits to man from the introduction of experimentation into the art of medicine.

ON NEUROLOGICAL AND PSYCHIATRIC DIAGNOSIS.

BY LEWELLYS F. BARKER, M.D.,

Professor in Medicine, Johns Hopkins University, Baltimore, Md.

On taking up the subject allotted to me, "The historical development and relative value of laboratory and clinical methods in diagnosis, with especial reference to neurological and psychiatric diagnosis," I must confess to have experienced some difficulty in deciding how to treat it. It was not entirely clear to me how sharply to separate clinical from laboratory methods.

If one means by a clinical method a procedure which is carried out at the bedside of the patient and by a laboratory method one which is applied in a room, building or workshop especially fitted with suitable apparatus for conducting investigations in diagnosis, he is making a distinction where there is not always a difference, for the bedroom, at any rate in hospitals, is a room so fitted, and is a laboratory. If by laboratory methods are meant those which can not be applied at the bedside, then we have relatively few laboratory methods of diagnosis in neurology and psychiatry, though the recent development of biological reactions and complex metabolic studies give promise of more in the near future. Most physical, chemical and psychological methods of diagnosis can be used at the bedside, though it is not always convenient to use them there. Or, if by laboratory methods we mean methods which are generally or more conveniently used in special rooms not occupied as the bedroom of the patient, then the field of laboratory diagnosis is wider, especially if, instead of limiting the examinations in these rooms to the study of materials removed from the patient, we take the patient himself there, as we often do, for the making of certain tests. But if the patient himself is removed to the laboratory for examination, the physician is at his side, and the method remains clinical. Thus it is obvious that bedrooms are used as laboratories and that laboratories are used for clinical work, and no sharp line can be drawn between the work and methods of the two places.

Nor is it feasible to distinguish clinical methods as methods of simple observation from laboratory methods as methods of experiment. For we make relatively few observations that are simple, unaided registrations of sense-impressions; on the contrary, the great

mass of so-called clinical observations are observations under particular conditions, modified at the will of the observer, that is to say, are experiments. Moreover, in all our clinical work—in the collection of facts, in the arranging of them, and in drawing inferences from them—the results of researches in laboratories are continually being utilized. Our observations, our arrangements of facts in sequence, and our conclusions are practically all based upon knowledge which at one time or another has been gained in special laboratories.

Thus while there are clinical methods in neurology and psychiatry which are not laboratory methods, and there are laboratory methods which can only remotely be regarded as clinical, it seems to me that all the methods used in neurological and psychiatric diagnosis must be regarded as clinical methods whether they are applied at the bedside or in any one of many clinical laboratories. My task is therefore made easier, and it will be permissible, perhaps, to devote all the time at my disposal to a brief consideration of the way in which neurological and psychiatric methods of diagnosis developed to their present status.

The clinic is the mother of the medical laboratories, and they have one and all since their birth contributed to the parental support. The anatomical laboratory dates back three hundred years. The physiological and physiological-chemical laboratories, the pathological laboratory, the pharmacological laboratory and the hygienic laboratory were creations of the nineteenth century. The first general clinical laboratory proper for internal medicine was established by von Ziemssen a little over twenty years ago.[1] The facilities now offered in well-equipped laboratories in connection with hospitals, manned by trained observers, are of incalculable value, bettering as they do the diagnosis, the prognosis and the treatment for the patients, besides serving for the promotion of knowledge. The recent division of the research work of the general clinical laboratory into biological, physical and chemical sub-departments marks another era in medical-laboratory specialization. The foundation of the electro-diagnostic and electro-therapeutic laboratory was a landmark in the history of clinical neurology, and the establishment of psychopathic laboratories, beginning with that set up by Kraepelin (1894), promises to be of fundamental significance for the advance of psychiatric diagnosis.

[1] Cf. Welch (W. H.), The evolution of modern scientific laboratories. Johns Hopkins Hosp. Bull., Balt., 1891, vii, 19–24.

The diagnosis of nervous and mental diseases made but slow progress until comparatively recent times. Mere clinical observation unaided could do but little until (1) laboratory studies had supplied some preliminary knowledge of the structure and functions of the nervous tissues and (2) the growth of psychology as a science had yielded some insight into the workings of the normal mind. Physicians had from early times on recorded a number of symptom-complexes, and pathologists had observed certain of the grosser lesions in the central nervous system, but a knowledge of the relation of symptoms to lesions grew far more slowly in neurology than in other departments of internal medicine. The reasons are not far to seek.[1] The mere mechanical difficulty of opening the skull and spine was an impediment to neuropathology. Further, owing to the chronic course of most diseases, those who observed the early symptoms rarely followed the cases to their termination, and in homes for the incurable and asylums where the late stages were passed through, there was too often lack of medical interest. The peculiar and complex structural organization of the nervous system was appalling to the majority of investigators. It was easier to study the pathology of diseases of the lung or liver, in which alterations in one area produced effects similar to those in another area of the same size, than to investigate the central nervous organs in which apparatus ministering to totally different functions may lie close together, perhaps only a few millimetres or a few centimetres apart, or in connection with which the disconcerting observation had been made that a lesion the size of a pin prick in one area can be of greater injury to the organism as a whole than the passage of a crowbar through another. In a whole series of diseases, manifestly of the nervous system, no anatomical changes were discoverable on thorough microscopic study of serial sections of the organs. It is but little wonder that the majority of physicians have preferred to work at problems which seemed easier to solve than those which the neurological and psychiatric inquirer is compelled to face.

Fortunately for the sciences of neurology and psychiatry, however, there have always been minds to which these problems have particularly appealed, and to which the difficulties, though great, did not appear insuperable. Romberg, inspired by Sir Charles Bell's great discovery of the sensory and motor nerves, and influenced by the more precise researches of Magendie, realized the value of

[1] Cf. Westphal (C.), Psychiatrie u. psychiatrische Unterricht. Berlin, 1880.

applying physiological knowledge to the study of neuropathology and to neurological diagnosis; he gave modern clinical neurology a firm foundation by developing knowledge concerning disease of the peripheral nerves. In psychiatry, after Pinel had broken the chains in the Bicêtre, and John Conolly at Hanwell had promulgated the doctrine of "no restraint," a great step forward was taken when Griesinger made it clear that the science is a part of neuropathology and inseparable from it, and showed how necessary a thorough knowledge of the latter is for scientific work in the former. Griesinger's recognition of the defects of medical teaching of neural and mental phenomena, and his demand not only for theoretical instruction, but for practical work by students in psychiatric clinics to be established at the universities, led first to the foundation of special clinics, and many years later to obligatory attendance and obligatory examinations in these subjects. These reforms gave an enormous impetus to the advance of both diagnosis and treatment in neurology and psychiatry.

Modern neurological diagnosis is a direct outgrowth of the physiological research undertaken on the nervous system at about the middle of the last century. The studies of the electrophysiology of muscles and nerves, the recognition of the spinal cord as an organ more or less independent of the rest of the nervous system, the inquiries into the functions of the organs of special sense and the relations of these to the higher psychic functions, the experimental investigations bearing upon the functions of the cerebral cortex—all were utilized for the extension of clinical methods of examination, and for the interpretation of clinical findings.[8] Slow but sure progress was made also through the control of clinical studies by autopsies and the macroscopic and microscopic examinations of the brain and cord. Especial activity in such studies was shown by the clinico-pathological school at the Salpêtrière, of which Charcot was leader. English neurologists, notably Hughlings Jackson and Gowers, also made valuable contributions. These, with the clinical electrical studies of Duchenne, Remak and Erb, did much to increase the accuracy of diagnosis. The invention by Helmholtz of the ophthalmoscope permitted the direct observation of a part of the central nervous system (the papillae of the optic nerves), a method of examination so important for differential diagnosis that every

[8] Cf. Erb. (W.), Ueber die neuere Entwicklung der Nervenpathologie und ihre Bedeutung für den medicinischen Unterricht. Leipzig, 1880.

neurologist feels impelled to perfect himself in it. The study of the neuroses, especially after the introduction of the Weir-Mitchell cure, helped to bridge the gap between neurology and psychiatry.

The laboratories of anatomy, physiology and pathology have afforded the data for the *diagnosis of the seat of lesions* and their nature. The localization has become more precise as these sciences have grown, passing from the gross terms cerebral, cerebellar, spinal and peripheral, through systemic, nuclear and segmental, to, more recently, the neuronal. Criteria for a *diagnosis of the nature of the lesion* have been drawn from pathological anatomy and physiology, and lastly, progress has been making in the *diagnosis of the causes* of nervous diseases through advances in pathogenetic studies. Time will not permit even a sketch of the contributions to diagnosis made by the various laboratory subjects, but anatomy, physiology, pathology, anthropology, biology, chemistry, physics and pharmacology all have lent a hand. The nature of the infectious diseases which involve the nervous system—cerebro-spinal meningitis, tuberculosis, syphilis, tetanus, influenza, leprosy, diphtheria—has been cleared up for us by bacteriological studies, and modern parasitology has revealed the mysteries of the coma of malaria and the sopor of African sleeping-sickness. The clinical laboratories have applied the methods of chemistry, physics and biology, and revealed to us the changes in the blood, the urine and the cerebrospinal fluid in nervous disease. New methods of examination are constantly being devised. Within a few months the workers in immunity problems have shown us how to demonstrate the presence of amboceptors for the syphilitic antigen in the cerebro-spinal fluid of patients suffering from dementia paralytica. Each year we learn not only how to see, how to hear and how to feel more precisely, but actually to see, hear and feel things entirely new to us, to make observations of phenomena which all through the preceding centuries have escaped detection by clinicians.

In searching for disturbances of motility, sensation, reflexes, nutrition, speech, intelligence, emotion or will, the tendency of modern neurology and psychiatry is to become ever more objective, to exclude as far as possible the subjectivity of the examiner in observation and record, for in this way only is it possible to obtain results which are comparable and which can be utilized for science. Hospital records strive now in describing what can be seen, felt or heard, to use words of pure description unmixed with judgments

or inferences, though that they still fall far short of their aim everyone who has occasion to consult these records knows. To counteract the errors of omission and commission of description, other still more exact methods of scientific registration are being more and more employed. Thus optic methods of reproduction, photography (simple, stereoscopic and cinematographic), are helpful in both neurology and psychiatry, and various graphic methods of investigating motor disturbances are gradually finding a place. The phonograph has been utilized for the registration of phonetic expressions, and the analysis of phonetic processes by motor graphic methods has been begun.

Perhaps the greatest progress making at present lies in the improvement of methods of investigating the psychic states and processes in nervous and mental diseases. The examination of the psychic side of a patient, often more important than the somatic inquiry, should, it is now realized, be carried out just as systematically and objectively as the examination of the physical condition. Psychiatry has suffered seriously from subjectivity. Thanks especially to the transfer of the methods of psychophysics to psychopathology, data are gradually being accumulated which are independent of the accidental subject of the observer. The principle of the "uniform stimulus" and the principle of the "reaction-time" have been adopted in the clinical psychopathic laboratory with gratifying results.[4] The testing of the perceptive faculty, the investigation of sense deceptions, the study of the orientation of the patient, the trial of memory, the examination of powers of work, and especially the inquiry into the characters of the associative processes, as conducted by the physician who has been well trained in the modern psychiatric clinic, permit of a precision and an extension to which the old clinical conversation could not attain. Though our knowledge of facts is as yet very incomplete, our comparable experiences with accurately studied material too small, to permit of much reliable clinical formalizing in mental disorder, there can be no doubt that as we continue to observe what actually occurs in nature, and to sift our observations empirically, separating as well as we can the essential from the episodal in the disease-picture, we shall arrive at generalizations that will give us a diagnostic power

[4] Cf. Kraepelin (E.), Der psychologische Versuch in der Psychiatrie. Psychol. Arb., Leipz., 1896, i, 1–91; Sommer (R.), Lehrbuch der psychopathoogischen Untersuchungs-methoden. Berlin u. Wien, 1899.

in psychiatry equivalent to that we possess in other branches of internal medicine.[5] The certainty with which it is now possible to make the diagnosis and prognosis in dementia paralytica is an instance in point. Hallucinations, delusions and abnormal moods, it has been discovered, are less essential for diagnosis than are disturbances of orientation and of the perceptive faculty, motor states and flight of ideas, single disturbances not pathognomonic in themselves assuming diagnostic importance according to their special grouping, as, for instance, in the well-known example of the different relations of confusion, excitation and orientation in katatonia, mania and amentia. The widening of the functions of the anamnesis in history-taking by Janet, and the emphasis laid upon the katamnesis by Kraepelin, have markedly enriched our diagnostic data in psychasthenic states in the one instance, and in processes which terminate in dementia in the other.

Among the more interesting features of contemporary psychiatric diagnosis is the attention which is being paid to the so-called psychoanalytic method, as practiced by Freud,[6] Riklin[7] and Jung.[8] Those who are working with Freud's method of investigating the psychology of daily life, of hysteria and of dreams are much impressed with the ingenious conceptions of that investigator and urge those who are skeptical not to condemn it on superficial examination or from prejudice due to Freud's over-emphasis of the rôle played by sexuality in the psyche. Some of the explanations which it is asserted the method affords almost remind one in brilliancy of the interpretation of the handwriting on Belshazzar's palace-wall. The search for the hidden psychic complex, to which some painful emotion is attached, unbearable in consciousness and accordingly suppressed, is proving to be a helpful idea in the study of psychiatric cases, Freud

[5] Cf. Kraepelin (E.), Ziele und Wege der klinischen Psychiatrie. Allg. Ztschr. f. Psychiat., 1896–7, liii, 840; Wernicke (C.), Aufgaben der klinischen Psychiatrie. Breslauer aerztl. Ztschr., 1887, 145.

[6] Freud (S.), Die Traumdeutung. Leipz. u. Wien, 1900; Zur Psychopathologie des Alltagslebens. (Vergessen, Versprechen, Vergreifen) nebst Bemerkungen ueber eine Wurzel des Aberglaubens. Monatsschr. f. Psychiat. u. Neurol., 1901, x, 1–95.

[7] Riklin, Zur Psychologie hysterischer Dämmerzustande und des Ganserschen Symptoms. Psychol.-neurol. Wchnschr., 1906.

[8] Jung, (C. G.), Diagnostische Associationsstudien, Leipzig, 1906; Die psychologische Diagnose des Tatbestandes, 1906; Ueber die Psychologie der Dementia Praecox; Ein Versuch. Halle, 1907.

maintaining that the hallucinatory delirium may represent a compensation for unsatisfied desires, hinting that man sometimes resorts to a psychosis in order to find in its dreamy states that which is denied him in real life.

Further studies suggest that much light may be thrown upon paranoiac states by assuming that they, like the mental stages of the hysterical, proceed from the suppression of painful memories, and that other symptoms in dementia praecox—the weakness of apperception, the perseverations, the tendency to symbolism, the stereotypism, the command-automatisms, the apathy, the aboulia and the negativism (to speak in the slang of the psychiatrists)—may be determined more or less by the suppressed complex. Such an explanation, however, in order to account for the stability and resistance of the paranoid dement, contrasted with the mobility of the hysteric, has to assume a fixation of the affectivity in the one, possibly due to some metabolic intoxication (Jung), which is absent in the other.

A very great impetus would be given to neurological and psychiatric diagnosis in America if psychiatric clinics were to be established in connection with every great hospital or medical school. It is humiliating to think that this country, so far in advance in many other respects, is fifty years behind Germany, Italy and France in the recognition and satisfaction of this particular need. Since one in every three hundred inhabitants of this country is either insane or feeble-minded, and the estimated cost to this country of psychiatric disease is, according to Dana, $85,000,000 annually, a cost which is increasing at the rate of 4%, the desirability of education in these matters is obvious enough. Half the money which was put into a temple recently reared by propagandists of a pseudo-scientific cult in Boston in order to minister to certain psychic needs of some of the American people, would have been sufficient to build a first-class psychiatric clinic. The psychiatric clinics should come in America, and at once. Fifty years late is better than later! There can be no doubt that America will, sooner or later, lead in this as she is doing in other sciences.

CHEMICAL AND BIOLOGICAL METHODS IN DIAGNOSIS.

BY ALFRED STENGEL, M.D.,

Professor of Pathology, University of Pennsylvania, Philadelphia, Pa.

It is impossible to present in the limits of this discussion any adequate account of the history of the relation of chemistry and the methods of biology to clinical diagnosis, and it were rash even to attempt a complete review of the relative value of chemical and biological methods as compared with the older clinical procedures. In the very beginning of my discussion I would insist that such a comparison, if undertaken in any spirit of partisanship, could not be other than harmful and unjust. In the rapid development of the more rigidly scientific methods of diagnosis emanating from the laboratory, a feeling of disregard, if not contempt, for the older clinical methods has too often made its appearance, not rarely perhaps on account of a greater familiarity of many with these newer means of investigation. In the course of my remarks I shall have occasion to indicate the varied directions in which greater accuracy of diagnosis has been attained and broader conceptions of the natural history of disease have been established through the aid of the methods of chemistry and biology, but it must not be forgotten that the original foundations of our modern medicine rest upon accurate observations of disease without the aid of these newer sciences. Furthermore, it is perhaps too commonly forgotten that the methods of laboratory investigation are subject to errors of personal equation; that they are surrounded with pitfalls for the unskilled or careless; and that their capacity for misguiding those who place implicit confidence in their results without regard to the care or skill of the individual to whom such examinations are intrusted, and without the check of confirmatory clinical examination, is in direct proportion to their reliability when carefully performed and their value rigidly estimated.

From time to time iconoclasts appear who decry either the clinical or the laboratory methods of diagnosis. Doubtless these serve some useful purpose, though their opinions are manifestly one-sided and born of a narrow conception of the whole problem. The broadly trained clinician can no more dispense with the newer methods than

with the older and more settled processes of observation and induction. Knowledge and experience with the laboratory methods alone is quite compatible with brilliancy but not with breadth of view, and familiarity with the clinical methods only does not constitute the equipment of a modern diagnostician. A substantial general education, which alone can give to the average man breadth of view and the capacity of reaching just conclusions in matters of any sort, thoroughly trained powers of observation, accurate clinical experience, and practical familiarity with the laboratory methods are the fundamentals upon which diagnostic acumen must rest. Without any one of these the product is unfinished. So far as laboratory aids are concerned, it may be well for those of a critical mind to recall that the successive steps in the knowledge of a certain disease have often been made possible largely or wholly by the help furnished from the laboratory, and that though the chemical or biological methods may afterward be unessential in studying a given case, the proper understanding of that case is none the less dependent upon the data available through such methods. It may, for example, be unnecessary to examine the sputum in some instances of pulmonary disease, but the routine application of this together with other laboratory methods enabled scientific physicians to establish more certainly the ordinary clinical distinction of allied conditions, and even in the cases cited the diagnosis would be somewhat more certain if fortified with the examination of the sputum. His is surely a mopic vision who sees cause for satisfaction in his ability to diagnosticate without laboratory aid when the clinical distinctions upon which his diagnosis rests were established by those who faithfully applied the laboratory method.

The Contribution of Chemistry to Diagnosis.

It is not surprising that the methods of chemical analysis were early applied to the study of physiological processes and to diagnosis; and, though we shall find abundant reason for disappointment in the results achieved, may it not be said with truth that the disappointments have been mainly evident when the flight has been too ambitious? The newer chemistry of the last few decades with its wider appreciation of the laws of physics has at least demonstrated some of the variables that were and are even now of necessity ignored in ordinary chemical methods. It is these factors in particular that will need incorporation in all new attempts to gauge

organic functions by chemical methods, and without them such methods must still remain but approximative and inexact. To the skeptic who believes that chemistry has contributed nothing to accuracy of diagnosis, we need but recall that the precise diagnosis of renal disease was quite outside the range of clinical methods till Bright demonstrated the relation of coagulability of the urine to organic disease of the kidney; that the differentiation of diabetes mellitus from polyuria and from some other metabolic disturbances rests upon the chemical methods of diagnosis; that our knowledge of acid intoxication, of various blood poisonings, and of certain nutritional diseases is almost wholly dependent on the chemical study of the secreta, blood and excerta. If we must in some cases admit disappointment in the scope and accuracy of chemical methods in immediate or ultimate diagnosis, we must nevertheless appreciate their indirect value in casting sidelights on the diagnosis of obscure conditions as well as their frequent direct value in determining variations in the course of disease.

Early Chemical Methods. The birth of modern chemistry may be said to have even date with the discovery of oxygen, and we may find in the literature of the period immediately following that date records of painstaking chemical studies, chiefly of the blood and pathological exudates, such as those of Andral, Denis, and other French clinicians. Lavoisier, who had named oxygen soon after its discovery, was quick to appreciate its fundamental importance in the process of life, and with La Place initiated studies of animal heat and respiration that were amplified by Liebig, Voit, Pettenkofer, Pflüger, Crawford and a long line of later chemists upon whose investigations has been based our knowledge of the science of nutrition. It was sometimes hoped that studies of the external and internal respiration might prove of direct value in practical medicine, as they have proved in solving various problems in the pathogenesis of disease. Though this hope has not been realized on account of the difficulty of the methods, the practical results achieved in the laboratory form the basis of much of our modern knowledge of nutritional disease.

Another early direction of chemical study was towards the physiology of special organs. Cotugno had recognized the coagulability of the urine even before the era of modern chemistry and Bright soon afterward demonstrated the practical diagnostic value of this chemical fact in the recognition of renal disease. Spallanzani had

recognized the chemical nature of digestion as early as 1793 and Prout discovered the acidity of the gastric juice in 1824. Beaumont's epochal study of the celebrated case of Alexis St. Martin was published in 1833. Not long after that date Claud Bernard began his work at the College de France and laid the foundations of our knowledge of the functions of the liver, discovered the action of the pancreatic juice and cast the first light on the nature of diabetes mellitus.

It may be profitable now to review very briefly some of the uses of chemical methods in the practical diagnosis of disease.

Disorders of Metabolism. The early methods, as I have already stated, were concerned with the study of the respiratory exchange of gases, and though of inordinate value in determining the fate of food stuffs and the production of heat and energy, thus establishing the science of nutrition, have proved of little direct practical value. The pathologist found these studies of interest in disproving the existence of decreased oxidation, often assumed to be present, in such diseases as anemia, gout, leukemia and diabetes, but the practical physician has too little reflected upon their relations to clinical medicine.

Proteid Metabolism. Liebig conceived the idea that the estimation of nitrogen elimination might be useful in determining proteid metabolism and Voit demonstrated nitrogen equilibrium, the balance between the intake of nitrogen in food and the output in urine and feces. The uselessness in nutrition of the nitrogen inhaled in atmospheric air had been long before established. Not unnaturally, urea as the chief end product of nitrogen metabolism and as a fairly determinable chemical body received a large share of attention, and notwithstanding fuller knowledge is still regarded by many as a valuable index of certain metabolic and excretory processes. In the light of present knowledge we recognize that increased ingestion of proteids and augmented tissue destruction may each increase the excretion of urea, while decreased ingestion, faulty absorption and defective excretory processes may reduce its amount. The mere determination of the amount of urea excreted in the urine, without reference to the nitrogenous intake and the degree of intestinal absorption, is therefore valueless, and even when the diet is fixed and absorption accurately determined, the proportion of urea independent of total nitrogen elimination is almost equally valueless. Much supposedly scientific labor is still wasted and erro-

neous deductions based on this useless determination. There are undoubtedly some scientific short-cuts which enable practical men to reach useful conclusions by establishing one main factor and ignoring others that are negligibly small, but the determination of urea in the urine is not one of these.

If proteid metabolism is under consideration, careful estimations of the total ingestion and total excretion and determination of the form of excretion are indispensable. Ready methods of measuring one factor cannot but lead to erroneous conclusions.

Studies of Purin Metabolism and the excretion of uric acid constitute a later sphere of chemical investigation. By slow processes we have learned that the uric acid of the urine has two sources: a part is derived from the nuclein of ingested food, a part from that of the tissues undergoing katabolism. It is highly probable that a certain part also is produced in the system by synthesis. Uric acid excretion is therefore dependent upon a number of factors and its amount may depend upon variable conditions. As matters of practical experience we know that the amount of uric acid in the urine is increased in leukemia, during the resolution of pneumonia and in certain cases of nephritis. The erroneous impression prevails that there is an increase of urinary uric acid in gout and in a variety of undiagnosed conditions summarized under the captions of uric acid diathesis, lithemia and the like. This mistaken idea is founded upon the fact that uric acid calculi are prone to form in such conditions and that deposits of urates or of uric acid crystals are likely to occur in the standing urine. The chemists have taught us over and over that these results are due not to increased excretion of uric acid but to conditions in the urine unfavorable to the solution of uric acid or its compounds. No fallacy has been so difficult to combat and to banish from the world of practical medicine. The lesson cannot too often be repeated that the apparent amount of uric acid as determined by the sediments or crystals seen in the urine, and even the accurate quantitative determination of the uric acid by chemical means, are practically valueless as diagnostic indications of gout. It was long ago contended by Garrod that there is in gout an increase of uric acid in the blood, and his familiar experiment of suspending a thread in the blood serum of a gouty person to observe the formation of crystals has more or less demonstrative value. Later studies by more accurate chemical methods (Duckworth, Klemperer, Magnus-Levy) confirmed his contention and

established that there is an increased amount of uric acid in the blood of gouty persons. So far as the elimination in the urine is concerned, the investigations of Hiss and Magnus-Levy have shown a diminution before acute attacks, an increase during attacks and practically normal amounts between the paroxysms. The figures, however, are not sufficiently striking to furnish any practical aid in the diagnosis of any stage of the disease. It would carry me too far to discuss the various theories that have been constructed to explain these quantitative relations of uric acid in the blood and urine, and the tendency to uratic precipitations in gout. Very recently some evidence has been adduced to show that there is a retardation in the formation of uric acid by oxidation of the nucleinic purin and instead a synthetic production of uric acid, which, on account of the absence in that case of thymic acid with which uric acid ordinarily circulates, is present in a less soluble and more readily precipitable form. It is clear that purin metabolism and the formation of uric acid are intimately connected with the pathology of gout, but it is a complete fallacy to base any attempted diagnosis of that disease on studies of the urine. An older theory (Kolisch) which assumed a retarded transformation of purin bodies into uric acid though at first attractive was founded upon analyses made by a faulty method. As for the so-called "uric acid diathesis," we must recognize that this is wholly suppositious. Knowledge regarding this is in inverse relation to the bulk of the literature bearing on it.

Carbohydrate Metabolism. Disturbance of the metabolism of carbohydrates is the most important process in pathologic physiology so far as the chemical means of diagnosis are concerned. It must be recognized that the presence of sugar in the urine is not the invariable result of faulty carbohydrate metabolism; nor does glycosuria invariably indicate such a metabolic disorder, but in the main this assumption is justified when glucose is recognized in the urine. The chemical methods, therefore, here assume an importance in diagnosis that cannot be under-estimated, and the same methods are further valuable in distinguishing glucose from other reducing bodies (glycuronic acid, the alkapton bodies and pentoses) which are found in quite different and far less important diseases. The recognition of the latter is wholly the province of chemical investigation.

Fatty Metabolism. In the normal katabolism of fat, it is probable that acetone, diacetic acid and oxybutyric acid are to some extent

produced. In abnormal destruction of fat, as in inanition, infections, fever, and diabetes, but especially in the latter, these bodies are often made in increased and sometimes destructive amounts. There results from this one of the known forms of acid intoxication or acidosis, the only genuine autointoxication, in the strict sense, with which we are familiar. Chemical methods have furnished us with a more or less complete understanding of such conditions as well as with the power of diagnosticating their approach or existence and with measures of treatment that sometimes prove most valuable.

Before entering on a more extended reference to the question of acid intoxication, let me recall to your minds some of the chemical modes of defence of the organism against toxic agents of fundamental importance to the understanding of acidosis in particular. The principal of chemical *detoxication* by the pairing of toxic bodies whether endogenous or exogenous with defensive substances of various sorts is one of far-reaching importance. Thus the indol and skatol of intestinal putrefaction after a preliminary oxidation are combined with sulphuric acid and eliminated as less toxic sulphates; to a less extent they combine with glycuronic acid. A familiar example of the same process of pairing is that by which glycocol combines with benzoic acid to form hippuric acid. Similarly sulphur may detoxicate cyanogen compounds by forming sulphocyanids; or bile acids may unite with various alkaloids. Far more frequent is the association of acids with cations. The final elimination of nitrogen as urea represents the normal physiologic type of this process, urea being the result of a combination of ammonia derived from proteid destruction with carbonic acid. In experimental investigations the direct administration of acids is followed by the combination of these acids with the fixed cations of the body and, when these prove insufficient, with ammonium. The intermediary metabolism is normally attended with a certain amount of acid formation of various kinds, and under pathologic conditions these acids are increased in amount, the katabolism of proteids and nucleins furnishing sulphuric and phosphoric acids, carbohydrate metabolism supplying lactic acid and in the fats diacetic and oxybutyric acid. When the salts of the food prove insufficient for neutralization, the acids appropriate the fixed cations of the body first and then ammonium for the purpose of neutralization. At some stage toxic symptoms appear. We need not here enter into a discussion, which

would necessarily be extended, as to the exact cause of the symptoms, whether due to the acidosis as such, to the particular form of acid, or to the withdrawal of the fixed cations or deviation of ammonium. Clinically the phenomena of acid intoxication are most familiarly recognized in cases of diabetes, but their occurrence in starvation, in wasting diseases, in destructive hepatic affections, in certain gastro-intestinal diseases notably in children, after anaesthesia, in puerperal toxemia and occasionally without discoverable origin, must be recalled. To what extent minor grades may play a part in various other conditions remains to be determined. The fundamental importance of the condition needs no discussion and the chemical method of diagnosis alone avails for its timely recognition and for the direction of effective treatment. I shall have occasion to refer very briefly to the question somewhat later when considering the chemical methods of investigating hepatic disease.

It s necessary now to leave the consideration of general metabolism without attempting to discuss such important questions as sulphur and phosphorous metabolism, the elimination of calcium and magnesium or various metabolic disorders of more or less independent nature like alkaptonuria, pentosuria, cystinuria and oxaluria, all of which depend for proper recognition and appreciation on refined chemical methods. To mention them suffices to indicate that chemistry has proved no mere embellishment in modern medicine. Without this aid their identification would have been impossible and their mere recognition almost equally so.

Not unnaturally, the clinician turned to the chemist for aid in recognizing the beginnings of various organic diseases and the existence of defective organic functions when the resources of morphology and ordinary physical diagnosis were exhausted. The diagnosis of liver diseases (cirrhosis or degenerations) at a stage of advancement at which recovery is hardly possible, the identification of renal disease in its fully developed grades and recognition of gastro-intestinal disorders of advanced type, ordinarily present no great difficulty to the clinician, since the pathologist has made us familiar with the association of certain clinical manifestations with the pathological lesions; but the newer aspirations of medicine demand a recognition of organic derangement before destructive changes have become advanced to irremediable stages, and except in the case of the heart, lungs, and nervous system the methods of physical examination are confessedly insufficient. From the beginning of more exact scientific medicine the study of the blood has

held out hope of solution of problems of this sort, a hope fanned to more active flame by the introduction of Ehrlich's fascinating methods of blood examination. But neither this morphologic method nor the older as well as recent chemistry of the blood have availed us much. Direct chemical examinations of secretions and excreta have aided somewhat, but it must be confessed that much more remains uncertain.

Chemical Diagnosis of Kidney Disease. Enough perhaps has been said regarding the recognition of albuminuria as a symptom of kidney disease. The fact that albuminuria may occur without renal disease does not detract from the value of this sign when disease of the kidney exists. Meltzer has very well said that the natural history of kidney disease was known for centuries before Bright's investigations, but it was the merit of this observer and of his observations that the positive recognition of disease of the kidney became possible. With his help the symptoms of the disease became more accurately known, and even in the absence of tests for albuminuria the informed clinician is now able to recognize nephritis. Without this test, however, the clinician, no matter how skilled, is deprived of a most effective method of diagnosis. That albuminuria occurs without nephritis and perhaps certain types of nephritis without discoverable albuminuria needs no particular discussion here. The fact remains that *constant albuminuria* is an indication of renal disease in the absence of definite disproof.

A word is sufficient to recall the value of the recognition of Bence-Jones albuminuria as an indication of disease of the bone marrow. The early hope of aid in diagnosis from the determination of other albumoses or peptone has proved deceptive. At the present time such determinations seem valueless.

In connection with other examinations of the urine mention may be made in this place of the diazo-reaction introduced by Ehrlich for the diagnosis of typhoid fever. The test is well known and its limitations generally recognized. The negative value is far greater than the positive since there are very few cases of typhoid fever in which the diazo-reaction fails during the stadium of the disease, but on the other hand quite a large proportion of cases of scarlet fever, pulmonary tuberculosis, pneumonia, measles and other infections in which it may occur. The exact proportion of cases of typhoid fever in which the reaction occurs cannot be stated, but seems to be well above 90 per cent. In febrile sequellae not due to reinfection the diazo test fails, while in true relapses it reappears.

The presence of a positive reaction in cases of meningitis or articular rheumatism in which it is nearly always absent, or in pneumonia, pulmonary tuberculosis and other conditions in which it is more frequent, has a certain prognostic value, being rather significant of an unfavorable outlook. On the whole the diazo-reaction must be regarded as a distinctly valuable addition to our diagnostic methods though its early promise has not been fulfilled.

Chemical Indications of Renal Sufficiency. Numerous tests have been proposed, but thus far none seems to offer definite hope of permanent usefulness in this direction. Various substances have been administrated with the idea that their prompt or tardy elimination in the urine might give some indication of the functional capacity of the kidney. Thus salicylates and iodide of potassium have been used by the mouth or by hypodermic injection and tests of the urine made after fixed intervals of time; similarly, methylene blue has been given and the time of first and latest discoloration of the urine noted; but the results of these methods have proved so variable and inexact that little confidence can be placed in them. A more recent procedure has been suggested by Claude and Manté and other French clinicians. This is based upon the assumption that a diseased kidney eliminates ingested chloride of sodium less readily than the normal organ. A final judgment regarding this method may not as yet be justifiable, but its value is certainly unproved. The phloridzin method is, perhaps, more trustworthy. If a hypodermic injection of 1 ccm. of 1:200 phloridzin solution is administered to a normal person, sugar will appear in the urine in from a half to one hour and will continue to appear during from two or four hours. A more tardy appearance or the failure to appear would signify the existence of renal disease. Further investigations of this method are desirable. In the case of any of the methods based upon renal excretion a certain skepticism is necessary since the promptness of elimination depends upon other factors than elimination alone.

Chemical Indications of Hepatic Disease. The chemical method is of little value in the recognition of jaundice when direct inspection of the patient's skin and mucous membrane fails to reveal that condition. Still there are instances in dark-skinned persons and occasional cases, in persons not dark-skinned, of very mild icterus (associated with cirrhosis of the liver for example) in which the demonstration of bile in the urine or in the blood serum may be possible when inspection gives uncertain indications. In cases

of beginning cirrhosis of the liver particularly I have found the frequent or continuous presence of traces of bile in the urine unattended with visible jaundice.

Next in importance to the recognition of bile in the urine and in some cases of greater value is the discovery of considerable quantities of urobilin. This chromogen is normally eliminated in small quantities, but is present in considerable amount in diseases of the liver (atrophic cirrhosis) as well as in conditions of blood destruction (as infections, intoxications, anemias, or after extravasations of blood into the tissues), in certain intestinal conditions and in carcinomatous cachexia. While therefore lacking the directness of a certain indication of hepatic disease, its presence in abundance may, under some circumstances, be highly significant. The methods of recognition are so simple that a more general use of the test is desirable.

Various methods have been proposed for the determination of insufficiency of hepatic function, based upon a recognition of the normal physiological processes. One of the first of these capacities of the liver to be recognized was its power to store up or destroy sugars.

Alimentary Glycosuria. Ingested carbohydrates are in part converted into glycogen and in part utilized in anabolic processes or burned. The liver seems to be intimately concerned in their final disposal and when the organ is diseased the assimilation of carbohydrates is presumably lessened. It would seem possible, therefore, to determine the functional activity of the liver by administering known quantities of sugar and observing whether or not excretion takes place in the urine. In normal individuals the limit of assimilation for glucose given to the fasting subject is about 100 grams. When quantities above this figure are administered glycosuria occurs. In some cases a hepatic disease alimentary glycosuria has occurred with decidedly less quantities, but, on the other hand, advanced liver disease is by no means incompatible with quite normal power of assimilation of sugar. In addition, it is well known that alcoholism, various neuroses, and exophthalmic goitre may occasion reduced assimilation of sugars even more definitely than any from hepatic disease. Recently it has been suggested that the administration of levulose and the occurrence of alimentary levulosuria (Sachs, Strauss, Lépine) is a more reliable test, but this too has failed of general confirmation.

Urea Formation. The fact that ammonium is converted into urea in the liver has suggested the administration of ammonium salts and the estimation of the excretion of urea as a possible method of estimating the function capacity of the liver. The results of different observers have varied, some finding in hepatic diseases a reduction in the power of conversion of ammonium into urea and consequently the appearance in the urine of the unaltered ammonium salts that were administered; others finding increased output of urea or results that varied without apparent reference to the hepatic disease.

Partition of Nitrogen. Recently the partition of nitrogen eliminated in the urine has been very carefully studied as a possible indication of hepatic disease. It cannot be doubted that in cases of severe disease of the liver the urea-nitrogen falls and the ammonium-nitrogen and undetermined nitrogen increase, but there are factors in the probable causation of these changes that are quite independent of a putative disorder of hepatic function and to some extent independent of actual disease of the liver substance. Thus, in acid intoxications independent of hepatic derangement, a similar alteration of nitrogen proportions will be met with. Again, it has been shown by Folin and others that when the total output of nitrogen is greatly reduced by limitation of proteid food or starvation, enormous relative as well as actual reduction in urea-nitrogen occurs, with corresponding increase in ammonium-nitrogen, kreatinin-nitrogen, uric acid-nitrogen and undetermined nitrogen. E. and O. Freund found in the urea-nitrogen in the professional faster Succi, when in extreme inanition, as low as 54% to 56% of the total nitrogen. The nature of the nitrogenous bodies that make up the relatively increased nitrogenous residue is uncertain, but very probably increased quantities of amido acids play an important part. If then, in cases such as the toxemias of pregnancy studied by Stone, Edgar, Williams, Ewing and Wolf and others, decreased proportions of urea-nitrogen and increased proportions of ammonium-nitrogen and undetermined nitrogen be found, it cannot be asserted that the altered relations are due to the functional disturbance of the liver when it is possible that the repeated vomiting in such cases, with possible acidosis, the effects of inanition itself with its reduced output of total nitrogen, and perhaps also a disturbance in the normal synthesis of simple nitrogenous cleavage products in the wall of the intestine, might each or all together contribute to the result with or without hepatic disease. Ewing and Wolf contend

very strongly for a primary disturbance of metabolism as the cause of the altered nitrogen excretion, but seem to me to undervalue the possible effect of vomiting and inanition independent of either liver disease or any supposititious toxemic state or disordered proteid metabolism. From a practical standpoint it seems to me unwise to assume from altered relations of nitrogen excretion the existence of hepatic disease, unless some other evidence, as, for example, an excretion of lactic acid and leucin and tyrosin or other products of intense hepatic disintegration, is also shown. These last named bodies, however, are met with only in cases of extreme hepatic disease and, therefore, have only a restricted value in practical diagnosis.

Detoxicating Function of the Liver. It has been shown that the liver exercises a certain detoxicating function toward various mineral and alkaloidal poisons, such as arsenic, atropin, and strychnin, and its part in the pairing of toxic intestinal products with glycuronic acid may also be recalled. Some rather crude experiments have been made to determine if a reduction of this detoxicating function could be recognized in an increased toxicity of the urine in hepatic disease (Bouchard). Though no practical method has been suggested, further investigations in this direction may prove helpful.

Chemical Determination of Pancreatic Disease. The relation of pancreatic secretion to fat absorption has long been recognized and the occurrence of fatty diarrhoea as an indication of pancreatic disease is sufficiently significant to merit recognition. It must not, however, be forgotten that other factors enter into the absorption of fat from the intestinal tract and that considerable grades of steatorrhea may occur independent of any disease of the pancreas or disorder of its secretion. Thus, in jaundice, well-marked, fatty diarrhoea has frequently been observed, and in intestinal diseases, such as amyloid degeneration, tuberculosis and simple diarrhoea, the same may occur. After the unreliability of the mere presence of excess of fat was recognized, certain investigators suggested that a more important fact is the discovery of excess of neutral fat, showing that the fat-splitting function of the pancreatic secretion is wanting. Müller, von Noorden, Weintraud and Katz, among others, obtained results which indicated the importance of this determination, but on the other hand equally careful studies in cases of pancreatic disease have shown that the splitting of fat was not specially affected. In

the absence of jaundice and diarrhoeal diseases, however, excess of fat in the stools must be looked upon as an important indication of pancreatic disease.

Excess of nitrogen in the feces and the recognition of undigested muscle fibres, like fatty diarrhoea, may result from a lack of pancreatic secretion and consequent failure of digestion of proteids. This symptom, however, is of distinctly less value than steatorrhea.

Fat-splitting ferment (lipase) has been sought in the urine as an indication of pancreatic disease. Opie has shown the presence of this ferment in a case of pancreatic disease with fat necrosis, at the same time demonstrating its absence in a non-pancreatic case used as a control. There are, however, several possible fallacies. It must be remembered that lipase occurs in practically all tissues in which fat is found, perhaps exercising a function in these situations as a synthetic ferment operating by reverse action, and it has been demonstrated in the urine by Zeri in a case of hemorrhagic nephritis in which pancreatic disease was not present. There are certain practical difficulties connected with the preparation and preservation of the ethyl butyrate used in the test, and it must be furthermore recognized that ferment action of this sort may be due to varied lipases or to a variety of substances other than fat-splitting ferment.

Cammidge has devised certain tests of the urine to demonstrate the presence of glyceroses (derived from glycerine resulting from the splitting of fat) and has even claimed the ability to distinguish between different forms of pancreatic disease according to the reactions obtained. It would be unprofitable to discuss these tests at length as they have not been confirmed by other investigators.

Sahli's Method. Glutoid capsules, gelatin capsules hardened in formalin, are supposed to be digested only by pancreatic juice. When such capsules containing iodoform are administered with an Ewald test meal, the saliva or urine will give reactions for iodin at variable periods according to the motility of the stomach and the digestive activity of the pancreatic juice. The precise value of this method has not yet been determined.

The nucleus test suggested by Schmidt is based upon the supposed digestion of cell nuclei by the pancreatic juice, other digestive ferments having no action upon them. In experiments in which the pancreas of dogs was extirpated, the nuclei of meat fibres came through the intestinal tract undigested. In clinical cases Schmidt and his pupils found that the digestion of the nuclei was always

accomplished in diseases other than pancreatic disease and usually absent in pancreatic disease. J. Dutton Steele has investigated the subject quite extensively and believes that the nucleus test is probably a rough indication of the presence or absence of pancreatic secretion, but that the relation between the nuclei of muscle and pancreatic digestion may not be specific and that the persistence of nuclei may be the result of a general lowering of digestive power quite as much as the sign of insufficiency of pancreatic secretion.

Ethereal Sulphates and Pancreatic Diseases. The ethereal sulphates of the urine are known to be formed by a combination of sulphuric acid with products of intestinal putrefaction of proteids. Since the bacteria of the intestinal tract are more able to cause decomposition of the relatively simple products of digestion than of native proteids, the proportionate amount of such putrefactive bodies (indicated by the amount of ethereal sulphates of the urine) becomes a measure of intestinal digestion of proteids or, in other words, of the presence and efficiency of pancreatic secretion. It has been shown in a number of striking cases that a low proportion of ethereal sulphates in the urine was dependent upon destructive pancreatic disease, and though the value of the test has not been confirmed in some other cases, and though a low proportion of ethereal sulphates may be due to other causes, the occasional value of this test is undoubted.

Glycosuria takes first rank as a symptom of certain pancreatic diseases, but cannot be regarded as positively indicative of such disease since there is a variety of causes that may produce temporary or even more durable excretion of glucose in the urine. When, however, this symptom is combined with steatorrhea and marked emaciation, the probability of pancreatic disease is very decided, particularly if jaundice is absent.

Chemical Methods in Gastric Diagnosis. The rôle of chemical processes in organic function was first recognized in the case of the stomach and is easily studied on account of the ready procurability of the gastric contents. Not unnaturally, therefore, clinicians have energetically studied the gastric secretions for diagnostic indications. After the introduction of the anilin-color methods of recognizing free hydrochloric acid, and the discovery of the absence of free hydrochloric acid in cancer of the stomach, and the reduction or increase of acid in various other diseases, a somewhat undue amount of importance was attached to the chemical methods, which were made the basis not only of diagnosis but also of classifica-

tion of gastric diseases. With increase of knowledge it has become evident that while a definite and sometimes considerable value attaches to the determination of the absence or presence and amount of free hydrochloric acid, such estimations can never rank as pathognomonic indications. So far as cancer is concerned, it must be admitted that while the constant absence of free hydrochloric acid is a sign of great value, cases are met with in which free hydrochloric acid is present either occasionally or constantly and sometimes in excessive amount. Besides, there are other diseases of the stomach (achylia; atrophy of the mucosa) in which constant absence of free hydrochloric acid may occur without carcinoma. Determinations of the amount of hydrochloric acid at different times when the conditions are as nearly alike as possible are of value in estimating the progress of cases of gastric disease; but the ingenuity expended in devising accurate methods for determining the exact quantity of total or free hydrochloric acid in given samples of gastric contents, may be regarded as practically wasted effort.

Somewhat after the hydrochloric acid era the presence of a considerable quantity of lactic acid was vaunted as a certain indication of carcinoma of the stomach. It is hardly necessary to discuss in detail the value of this sign. Fuller knowledge has established the fact that lactic acid is formed in the stomach contents when there is stagnation of food and absence of free hydrochloric acid. The determination of lactic acid, a variable end result, is, therefore, somewhat less valuable than the recognition of the factors that give rise to it, both of which are readily demonstrable. As a confirmative test, however, the recognition of lactic acid is of some value though it is by no means positively indicative of carcinoma of the stomach.

Determinations of pepsin and the curdling ferment have not proved as helpful in diagnosis as has been hoped and may be regarded as of but occasional and minor importance.

Recently Sahli has added a method that promises to be of decided value which is carried out as follows: A small rubber bag containing methylene blue is securely tied with catgut so that the contents cannot escape unless the catgut is digested. As solution of connective tissue like that of catgut cannot occur through action of the pancreatic secretion without preliminary action of the gastric juice, the bag with its contents will pass through the intestinal tract unopened if gastric secretion is absent. If the catgut is

digested the escape of the methylene blue will be promptly recognized by the blue discoloration of the urine.

Various other chemical tests have been suggested for determining the motility of the stomach and the absorptive power of its mucosa. These are more or less valuable in certain cases though rarely contributing data of fundamental importance in diagnosis.

Far more valuable than the chemical diagnosis of gastric disease are the physical methods of determining motility, size, and position of the organ with the aid of the stomach tube, inflation apparatus and skiagraphy. In conjunction, however, with the data so obtained chemical methods are undoubtedly of some value.

Chemical Methods in the Diagnosis of Intestinal Diseases. Reference has several times been made to the fact that ethereal sulphates of the urine are combinations of oxidized products of intestinal putrefaction with sulphuric acid. Among these intestinal products, indol, skatol and phenol are most important. The amount produced will depend upon the amount of ingestion of proteid foodstuffs, as it is from proteid decomposition that these substances are derived; furthermore, the degree of decomposition will depend upon the efficiency of pancreatic digestion, as has already been pointed out, and upon local intestinal conditions, favorable to the action of micro-organisms of putrefaction. Generally speaking, it may be assumed that a persistent high proportion of ethereal sulphates indicates intestinal decomposition though there are other factors which may occasionally be operative. The attempt has been made to establish as an index of intestinal putrefaction the amount of indican (one of the ethereal sulphates) excreted in the urine. Careful investigations have shown that the amount of indican may not be proportional with the total aromatic-sulphate excretion, so that in some cases a high proportion of indican may occur with a relatively low proportion of total aromatic sulphates or the reverse. Accurate work, therefore, demands the estimation of the ethereal sulphates as a whole rather than the indoxyl sulphates alone or any of the others alone.

Enterogenous albumosuria was at one time thought sufficiently distinctive to prove of diagnostic value. In cases of ulcer of the stomach or intestine the administration of albumose in quantities of from 40 to 60 drams is followed by excretion of albumose in the urine. The difficulty of distinguishing various forms of albumose, especially in the presence of albumin and the variety of conditions

under which albumoses occur in the urine, have robbed this test of much of its expected value.

Occult blood. A recent method that seems to possess distinct value is that by which quantities of blood, too small to cause a visible alteration in the color of the feces, may be recognized by chemical means. The continuous loss in blood, in even this slight amount, may occasion serious anemia of seemingly uncertain etiology. Such cases may be cleared up by the repeated demonstration of occult blood in the stools. Again a diagnosis of gastric or intestinal ulceration or carcinoma of the gastro-intestinal tract may be made possible in the same way. The limitations of the test and the conditions under which it should be performed have not, perhaps, been as thoroughly worked out as is desirable. The influence of certain kinds of diet, for example, needs further study, and the frequency with which enough blood escapes to occasion a positive test in such conditions as cirrhosis of the liver, chronic cardiac disease or other disorders producing intestinal congestion remains to be determined. The possible value of the test, as foreshadowing hemorrhage in typhoid fever, may be alluded to, though final deductions cannot be made.

The Value of Biologic Methods in Diagnosis.

Whatever difference of opinion may be regarded as justified in the estimation of the value of chemical methods in diagnosis, surely no controversy can arise regarding the enormous strides that have been made in the more accurate knowledge of infectious diseases and in their more certain diagnosis since the introduction of scientific methods of biological investigation. The powers of observation and acumen of older clinicians like Rush, Louis and Bretonneau made it possible for clinicians to distinguish between certain forms of infectious disease which have superficial resemblances, but the accurate knowledge of infectious processes necessarily dates from the introduction of biological methods by Pasteur and Koch. The possibility of isolating specific organisms from the bodies of the sick and determining their biologic properties presents a means of diagnosis of assured accuracy for the diseases in which the specific organisms have been determined. A wider field of application of biological principles was thrown open by the serum studies of Bordet and Ehrlich and their various followers. With the aid of the cultural methods of Pasteur and Koch and the serum reac-

tions of the latter investigators, a degree of certainty has been attained in diagnosis that must have remained impossible to the older method of clinical investigation, and it may be profitable to review very briefly some of the important relations in which the biologic methods have proved practically valuable.

Diagnosis based upon the morphologic characters of discovered micro-organism. There is a certain number of diseases in which the constant presence of a definite micro-organism and its peculiar relations to the lesions of the disease establish its probable pathogenicity though it has been found impossible to isolate the organism in pure culture or even if so isolated to reproduce the disease in lower animals. In such diseases a diagnosis is often established by the discovery of the organism in question. In other cases, though it has been possible to obtain the organism in pure culture and to reproduce the disease in animals, such results are too difficult for ordinary clinical purposes. Thus, in tuberculosis of the lungs, malaria, amoebic dysentery, relapsing fever, Plaut's or Vincent's angina, lepra, trypanosomiasis, and various other parasitic diseases, a prompt and certain diagnosis may be attained in this way. In some others, as pneumonia, gonorrhoea, diphtheria, cholera, and influenza, a presumptive diagnosis may be made; to be confirmed by the isolation in pure culture of the specific organism. Recently there has been added to the list of organisms, which may thus aid in diagnosis, the Spirocheta pallida of syphilis. The exact place of this organism has not yet been positively established, but its constant presence in syphilitic lesions is highly suggestive.

Diagnosis based on isolation in pure culture of the specific organism. It is an every-day experience of practical physicians to call in requisition public clinical laboratories for the diagnosis of cases of diphtheria, and it is well known that without this aid the positive recognition of many cases of the disease would be impossible, while other conditions superficially resembling this disease would, as in the past, be still mistakingly regarded as true diphtheria. In connection with this disease, it is well to recall the fact that the mere presence of a specific micro-organism on the surface of the mucous membranes, or sometimes even within the tissues, does not, of necessity, indicate the existence of the specific disease with which that micro-organism is related. Thus diphtheria bacilli may be present in virulent form in the normal pharynx or naso-pharynx and may continue to multiply in that situation for considerable periods

of time. This fact has sometimes occasioned misunderstanding between practical physicians and public health authorities, but the practitioner should recognize that so far as the community is concerned, an individual, though healthy, carrying in his throat virulent diphtheria bacilli, is nearly as dangerous to others as one actually suffering with diphtheria.

Another disease in which the isolation of the specific organism has become of primary importance in diagnosis, especially in obscure cases, is typhoid fever, to which, however, more particular reference will be made in another place.

To the above may be added pneumococcus infections, streptococcus infections, cerebro-spinal fever, cholera, influenza, the plague, tetanus, anthrax and glanders, actinomycosis and a number of others. Not only does the bacteriological method avail in the ordinary diagnosis of these infections, but it has established the fact that some of them may occur in the usual local forms or as a general septicaemia. Thus, in the case of pneumonia, there may be the ordinary pulmonary lesions with their consequences or, in other cases, a general pneumococcemia; and in the case of the typhoid bacillus exceptional cases may be met with in which the organism has occasioned local or general lesions apart from the usual situation in the intestinal tract.

Diagnosis based on isolation of organisms and animal inoculation. In some cases, though the organism is readily discovered and isolated with more or less facility, the final determination of its nature cannot be positively determined until inoculation in animals has been made. Thus, in certain instances, cultures suggesting diphtheria bacilli or those of glanders and plague require the confirmative test of animal inoculation for their positive identification. With the introduction of serum methods the necessity of animal inoculations have been somewhat lessened and the original postulates of Koch may in some cases be set aside even as to the pathogenicity of a certain organism when serum reactions of a distinctive character are obtained.

Diagnosis based on inoculation with products of disease. In some cases the isolation of the specific organism, though possible, is so tedious or difficult that a diagnosis is more readily obtained by the direct inoculation of portions of the diseased tissue or pathological exudates. Thus, in the case of tuberculosis, clinicians constantly make use of inoculations of animals with emulsions of the

diseased tissues, transudates from the serous cavities, or excretions. This method not only serves to demonstrate the specific nature of the process, but is useful in distinguishing certain organisms, such as the smegma bacillus or various hay bacilli and other acid proof organisms, from the tubercle bacillus to which they bear a close resemblance.

Recent investigation seemed to indicate the possible usefulness of direct inoculation in the diagnosis of doubtful cases of syphilis, since it has been shown that though most experimental animals are refractive to this disease it may be transmitted to certain monkeys under proper conditions.

Serum Reactions.

It would lead too far were I to enter on a discussion of the known or supposed mechanism of various serum reactions and it is unnecessary to the present discussion to do so. The practical value of some of the more important reactions is of principal interest to-day. The special advantage of these methods lies in the fact that the serum of the patient alone is necessary, the cultures of the specific organisms to be tested having been obtained from other sources. The serum methods, therefore, possess a considerable advantage over the cultural methods in their ready application.

Agglutination. The agglutination reaction of Pfeiffer has been made available for practical purposes by Gruber, Durham and Widal. It has been especially applied in the diagnosis of typhoid fever, colon infections, bacillary dysentery, Malta fever, and glanders, and with less success in tuberculosis and some other diseases. Furthermore, the routine application of this test has led to the discovery of paratyphoid and para-colon infections simulating typhoid fever, and may be hopefully regarded as a possible means of still other differentiations.

The value of the agglutination test or Widal reaction in the diagnosis of typhoid fever cannot be too highly appreciated. Its routine employment by the public laboratories of cities and states has, to a considerable extent, reformed our public records and has in equal measure proved valuable to the practitioner as a guide to proper treatment. In typical cases, the physician may not require this assistance, but in many doubtful ones it has served to distinguish between typhoid fever and malaria or other febrile affections.

It must be remembered that errors are possible in laboratory technic quite as much as in clinical work. The proper performance of the test is of the utmost importance. "Ready methods" of applying it, as in the use of Ficker's *diagnosticum,* and its general employment by physicians not skilled in laboratory methods may be regarded as uncertain advances. When carefully performed by an expert the Widal reaction is likely to prove positive at some stage of the disease in from 95% to 98% of all cases; and as early as the 7th or 8th day in above 90%. It proves negative in even a larger proportion of non-typhoid cases. There are undoubtedly instances of non-typhoid disease, in persons who have never had typhoid infection, in which a positive Widal test is obtained despite all precautions regarding dilution, etc. Such cases, however, are highly exceptional.

The agglutination reaction is decidedly less valuable in the other diseases in which it has been employed; especially is this true of tuberculosis, in which some certain means of recognizing the infection in its earlier stages is so desirable.

Precipitins. The serum of animals or human beings suffering from various infections will cause a precipitate in the clear filtrate from cultures of the organism causing the infection. The "precipitin" causing this phenomenon is more or less definitely specific; at least the precipitation is manifested to a much smaller extent when a culture of another organism is used. The precipitation reaction has, however, been little employed in the diagnosis of infections. Its greatest usefulness has been found in its applicability to certain medico-legal problems, among others, the differentiation of human from other blood. When any albuminous substance is injected into an animal there develops into the blood serum of this animal, after a certain interval, a specific precipitin which will cause a precipitation of the same albumin from dilute solutions. Thus, when human blood is injected the blood serum of the animal will precipitate dilute solutions of human blood alone, with the exception probably of that of certain monkeys. The reaction here is far more specific than in the case of bacteria.

Opsonins. A. E. Wright discovered that the serum of normal persons or those infected with various micro-organisms contains a substance or substances which act upon the infecting organisms in such a way as to make them readily susceptible to phagocytic inclusion in leucocytes. The presence of these substances—called *opso-*

nins—increases the activity of phagocytosis and thus aids in the combat against the infection, while their absence retards phagocytosis and therefore enhances the infection. The opsonins appear to be complex bodies having a relatively resistent thermostabile portion and a ferment-like thermolabile portion. It would appear that there are normal opsonins present in every serum and more specific kinds developed by specific infections. The certainty of this distinction requires confirmation, especially if we are to admit the claim of some of the enthusiastic workers in this field, that it is possible to distinguish which one of a mixed culture of organisms was the specific one in a given case by testing the opsonic power of the patient's serum against each of the organisms, and observing which one was most actively appropriated by the phagocytes. As a rule, no such definitely specific relation has been claimed for the opsonins, and investigators have been content with determining that the serum of a patient suffering from a certain infection exhibits a high or low opsonic power against the organism concerned in the disease, without attempting to show that the opsonic power was greater in the case of this than in the case of other micro-organisms. Even this determination, however, is generally admitted to be difficult, and the range of error is excessive. Some fundamental improvements in the technic are needed, but it is not too much to hope that when such are attained the opsonic method will furnish a useful indication of the susceptibility or insusceptibility of individuals to certain infections and a useful guide to treatment by vaccination methods. Whatever may be said of the method of quantitatively determining opsonic power (opsonic index), the underlying facts regarding the nature and operation of opsonins seem to be established.

Bacteriolysis. Normal sera frequently exhibit the power of destroying bacteria, and the sera of infected animals or of man suffering with certain infections may present this property in a more or less specific manner, being destructive for the specific organisms concerned in far higher dilutions than are other sera. This specific cytolytic action has been demonstrated very strikingly in the case of trypanosomes by Novy. The principle of bacteriolysis has not, however, been specially developed as a diagnostic aid.

Deviation of the Complement. Recently a new method of diagnosis has been introduced which, if confirmed in its asserted accuracy, may open the way for diagnosis of a variety of conditions,

infectious and non-infectious, the specific organisms or causes of which may not as yet be certainly known. The principle on which this method rests was discovered by Neisser and Wechsberg while investigating the action of rabbits' serum on the vibrio of Metchnikoff. They found that the addition of too much amboceptor prevents the bacteriolytic effect of the immune-serum and suggested that the explanation of this is that the amboceptor uniting with the complement binds, deflects, or deviates it so that the expected bacteriolysis did not take place. This principle has been applied to diagnosis in a variety of ways and can be best illustrated in a schematic manner.

DEVIATION OF THE COMPLEMENT.

A.

1) Sheep Corpuscles + Hemolytic Rabbit Serum } = hemolysis.
(Receptor) + (Amboceptor and Complement) }

(2) Sheep Corpuscles + Hemolytic Rabbit Serum Heated } = no hemolysis.
(Receptor) + (Amboceptor) }

(3) Sheep Corpuscles + Hemolytic Rabbit Serum Heated + Guinea Pig Serum } = hemolysis.
(Receptor) + (Amboceptor) + (Complement) }

B.

(1) Antigen (Bacterium or Diseased tissue, etc.) + Homologous Serum + Guinea Pig Serum } *After incubation.* = Complement bound.
(Receptor) + (Amboceptor) + (Complement) }

2) Antigen (Receptor) + Heterologous Serum (Amboceptor) + Guinea Pig Serum (Complement) } = Complement free.

C.

B(1)+A(2) = No hemolysis, and indicates that the serum tested and the antigen were homologous.

D.

B(2)+A(2) = hemolysis, and indicates that the serum tested and the antigen were heterologous and left the complement of the guinea pig serum free to act on A(2) as it did when added directly as in A(3).

A. A hemolytic serum is prepared by injecting washed sheep's corpuscles into rabbits. (1) After a certain interval the rabbits' serum becomes hemolytic for sheep's corpuscles. The sheep's corpuscles, having specific receptors, will unite with the amboceptor or hemolytic intermediary body of the rabbit serum; the complement of the same serum again uniting with the amboceptor and effecting

the complete hemolysis of the sheep corpuscles. (2) If the rabbits' serum be heated the complement is readily destroyed, leaving only the amboceptor; a mixture of sheep corpuscles with such heated serum does not result in hemolysis. (3) The addition now of unheated guinea pig serum would supply complement and restore the hemolytic quality of the rabbits' serum which had been destroyed by heating.

B. (1) If bacterial bodies, such as typhoid bacilli, tubercle bacilli, meningococci, etc., be mixed with serum or transudates, such as spinal fluid, from diseases corresponding to the bacteria, the amboceptor in the serum will unite with the receptor of the bacterial cell and any added (guinea pig serum) complement. (2) This union will not take place if the bacterium is not the same as that which was operative in the case from which the serum or exudate was obtained. Thus, if typhoid bacilli were treated with serum from tuberculous cases, no union of the receptor (typhoid) with the amboceptor (tuberculosis) would occur.

The two systems represented in A and B may now be applied in a practical way for the diagnosis of certain cases.

C. Suppose that, as in B (1), typhoid bacilli + typhoid serum + guinea pigs' serum be mixed and placed for an hour or more in an incubator. A firm combination of the receptor of the bacilli, the amboceptor in the typhoid serum and the complement in the guinea pigs' serum would result. If this mixture be then added to heated hemolytic rabbits' serum (as in A (2)) + washed sheep's corpuscles, no hemolysis would result because the complement of the guinea pig serum, which might have been available to complete the hemolytic system as described above in A (3), has been firmly bound to the amboceptor of the typhoid serum in the preliminary step of the test.

D. If the serum used in the preliminary step was not typhoid serum the receptor of the typhoid bacillus used in the test would not have united with the amboceptor present and the guinea pig complement would have been left uncombined as in B (2). In that case, the subsequent addition of heated hemolytic rabbits' serum + washed sheep's corpuscles would result in hemolysis because the complement of the guinea pig serum in this case is free to effect a union with the hemolytic amboceptor in the heated rabbits' serum.

Thus, if the organism employed is known and the serum combined with it is unknown, the non-occurrence of hemolysis shows

that the two were homologous, while the occurrence of hemolysis proves that they were heterologous. A diagnosis of infectious diseases is therefore rendered possible, and has been practically demonstrated in the case of infections with typhoid bacilli, meningococci, gonococci, tubercle bacilli and other organisms. The test, however, has a far wider applicability as has been shown in studies of syphilis. In this case, though the specific organism is not certainly known and cannot therefore be used, portions of undoubted syphilitic tissue, such as the liver or spleen of a case of congenital syphilis, may be utilized, for these tissues probably contain the infective organism as well as the specific receptors. The method has been applied for syphilis in the case of general paralysis and various other nervous diseases, and the fluid from the spinal canal has been used to furnish the amboceptor. A mixture composed of hepatic or splenic tissue of syphilitic origin + fluid from the spinal canal of a case of general paralysis + guinea pig serum is prepared and after suitable incubation is added to heated hemolytic rabbit serum + washed sheep's corpuscles. The non-occurrence of hemolysis shows that the spinal fluid contained syphilitic amboceptors, whereas the occurrence of hemolysis proves the spinal fluid free of syphilitic amboceptors and, therefore, presumably of non-syphilitic origin. As the material for this test would sometimes be difficult to obtain if it were necessary to use fresh tissue from syphilitic cases, several investigators have worked with tissues from infected monkeys and have demonstrated the reliability of this material.

The possibility of still wider application of this test of deviation of the complement extending it to non-infectious processes is shown by the fact that it has been applied successfully in the differentiation of various albuminous bodies by using these bodies as the antigen (receptor) and the serum of animals, which had been injected with the same bodies, to supply the amboceptor. The results of these investigations indicate that the differentiation of egg albumin, serum albumin, and other albuminous bodies by this method is as accurate as that by the older method of precipitin-formation referred to before. It is not improbable then that the method of deflection of complement might be applied to diseases such as carcinoma and sarcoma in which the infectiousness, though suspected, may not be hereafter confirmed. Work along this line may not unlikely lead to useful results.

Diagnosis based on injections of bacterial products. Among the most accurate of all means of diagnosis and one which illustrates

the very great value of biologic methods in practical medicine is that referred to in the heading. Its application has proved most satisfactory in the case of tuberculosis and glanders.

Diagnostic use of Tuberculin. It is unnecessary to enter into great detail regarding the diagnostic value of tuberculin. This has been proved by veterinary surgeons, who have the advantage of being able to determine the correctness of their conclusions by killing the animals after the test has been made. These experiments show that the result is positive in at least 95% of the cases. It is not improbable that in man as high a percentage or even a higher may be obtained. The economic value of this test in the warfare against tuberculosis of cattle may not be passed over without mention. The diagnostic use of tuberculin in man has been restricted by the fear that dissemination of the disease might be caused by the injections. This fear has substantial ground when large quantities of tuberculin are used, but it is unnecessary to employ larger amounts than from ½ to 3 milligrams. Such quantities, in my own experience as well as in that of those who have used it even more freely, are harmless. It must not be forgotten that a possible error in diagnosis may arise from the fact that an injection of tuberculin may occasion a reaction on account of the presence in some part of the body of an inactive or latent focus of tuberculosis which is not at all connected with the active disease from which the patient at the time is suffering. In this way the mistake of regarding something else for tuberculosis might occur.

Diagnostic use of Mallein. Though not of special interest in human medicine, since glanders is a rare disease in man, a word regarding the use of mallein is fitting here as another instance of the aid rendered by biologic methods. Veterinarians place the greatest confidence in the accuracy of this test, and it has proved of advantage in the control of glanders among animals.

Having considered, in a more or less general way, the kinds of biological data employed in diagnosis, it may be well to refer more particularly to one or two of the special methods and to the value of applying various biologic methods in certain important diseases.

Blood Culture. The improvements in the technic of blood culture that have been made in the last few years enable the trained bacteriologist to isolate from the blood various micro-organisms concerned in evident or obscure infections. Among other diseases typhoid fever deserves mention because blood culture has been the method

upon which the final distinction between this disease and the variety known as para-typhoid has been established, and also because culture alone makes it possible to recognize some cases of typhoid fever in which the serum reactions and the clinical symptoms may fail. Next in importance is the aid which blood culture has given in the diagnosis of septicaemic conditions. In puerperal sepsis, osteomyelitis, general pneumococcic infection, bacteriologists readily determine the nature of the condition and the biologic cause. In two instances I have seen a diagnosis of puerperal septicaemia changed to typhoid fever as a result of blood culture at a time when this method only could have established a prompt diagnosis.

Examination of serous exudates and cerebro-spinal fluid. The importance of careful biologic studies of the exudates in the serous cavities in the final diagnosis of the nature of certain cases of pleurisy, pericarditis, peritonitis, arthritis, etc., need only be mentioned. Gonococcic arthritis has been frequently distinguished by this means from other forms, and in many cases could not be distinguished by ordinary clinical methods. The same is true of pneumococcic arthritis. Direct culture is sometimes insufficient and the more time-consuming method of animal inoculation may be required, especially when the possibility of tuberculosis is concerned.

The comparative safety of the operation of lumbar puncture has placed in the hands of the bacteriologists another kind of material for investigation, and has enabled the clinician, through the aid of bacteriological methods, to distinguish with certainty between meningococcic or other forms of meningitis and tuberculous meningitis. Furthermore, if the test of the deviation of the complement is fully established along the lines of its present promise, it may be possible to distinguish between syphilitic or parasyphilitic and other forms of disease of the central nervous system.

Typhoid Fever. In no disease have the biologic methods of study been utilized to better advantage than in the diagnosis of typhoid fever. After the recognition of the specific micro-organism of the disease, it was first attempted to establish diagnosis upon the basis of examinations of the stools for the typhoid organism, and, though exceptional bacteriological training is necessary for this examination, the introduction of special media, such as those of Elsner, Piowkowski and Hiss, has made it possible to distinguish between the typhoid organism and the coli group as well as other confusing forms. In the course of time bacteriologists discovered that the

typhoid organism is also excreted from the body through the urine and various investigators found it possible to isolate it in a considerable proportion of the cases of typhoid fever. Furthermore, it was established that a typhoid pyelitis or cystitis might exist for a time after the subsidence of the general infection. Finally examinations of blood or fluid obtained from the spots in the skin and then cultures of the blood taken directly from a vein were found to give satisfactory results. At the present day the greatest interest attaches to cultures of the blood itself, and with improved methods a positive result is obtained in a large proportion of cases even in the early stages of the disease. It is unnecessary to review the methods employed, but it is well to refer to the peculiar advantage of the bile-containing media of Conradi. With the use of these, the amount of blood necessary may be considerably reduced, and not rarely cultures are obtained from such quantities of blood as may be had from an incision into the lobe of the ear or the end of the finger. Usually, however, this amount of blood is rather too small. In a number of cases in my service at the University Hospital, Dr. Klaer has obtained positive cultures before the Widal test was positive and before the clinical diagnosis could be established with certainty.

Before the introduction of these improvements in technic of blood culture, the reaction of Gruber and Durham and Widal became a routine procedure in medicine. Its advantages have already been referred to. Finally, for the sake of completeness, reference may be made here to the deviation of the complement as a further possibility. The test of the urine for the diazo-reaction has also been mentioned in another place.

Tuberculosis. In many cases of pulmonary tuberculosis the diagnosis is made positive by the discovery of the tubercle bacillus. It must be recalled, however, that there are organisms which bear a puzzling resemblance to this and require differentiation in some cases; more often, however, in suspected renal or intestinal tuberculosis than in the case of the pulmonary disease. Morphological methods are generally sufficient, but sometimes must be supplemented with inoculation of animals and culture.

Inoculation of animals, while a tedious process, has the advantage that it does not require the unusual technical facility which cultivation of the tubercle bacillus calls for, even with all the improved methods that have been introduced.

In a few instances of tuberculosis in man, culture methods have been used to differentiate between an originally human or bovine infection. To what extent this differentiation is sound and may be made more common remains for the future to determine.

Much has been said regarding the importance of mixed infection in tuberculosis of the lungs. The attempt to determine a mixed infection by the examination of sputa is crude, inexact and out of date. Blood culture has in a certain proportion of cases demonstrated the presence of the organisms causing the secondary infection, but it is probable that in many instances a secondary infection might exist in the lungs though the organisms of that infection had not, as yet, gained access to the blood. The utilization of serum reactions here opens a hopeful field for investigation, and one which has not yet been taken up to any considerable extent.

It is unnecessary to speak again of the value of tuberculin in the diagnosis of this disease except to express the hope that, if the harmlessness of small doses is found as certain as Trudeau and some others believe, a more general introduction of the method may result. Some other means, however, is desirable for the recognition of this disease before the infection of the lung has become extensive enough to occasion distinct physical signs or the discharge of the bacilli in the sputum. Perhaps the test of the deviation of the complement may fill this rôle.

Rabies. Though infrequent, this disease is important on account of its severity and, as far as our discussion is concerned, on account of the peculiarly close relation of biological methods to its diagnosis and cure. Two methods of diagnosis are of interest to us. In the first the recognition of the disease depends upon the discovery of certain proliferative changes in the endothelial capsule surrounding the nerve cells of various cerebral and spinal ganglia. These changes, described by van Gehuchten and Nelis, in man and animals dead of the disease have been confirmed by a number of investigators. They are not, however, sufficiently regular in occurrence to be wholly satisfactory for diagnosis. Among the cases of rabies and suspected rabies examined in the laboratory of the State Live Stock Sanitary Board of Pennsylvania, Dr. Reichel obtained the following results:

Positive Cases of Rabies.

	Medulla Oblongata.	Gasserian Ganglion.	Sympathetic Ganglion.
Proliferation changes found in.....	81 or 66.5%	135 or 100%	28 or 82.4%
No proliferation changes found in....	44 or 33.5%	.....	6 or 18.6%

Negative Suspected Cases of Rabies.

	Medulla Oblongata.	Gasserian Ganglion.	Sympathetic Ganglion.
No proliferation changes found in....	29 or 96.6%	18 or 69.2%	3 or 60%
Proliferation changes found in.....	1 or 3.3%	8 or 31.8%	2 or 40%

The second method is that which depends upon the recognition of the so-called Negri bodies. Dr. Reichel's figures here prove more certain.

Positive Cases of Rabies.

	Hippocampus Major.	Cerebellum.	
Negri bodies found in.....	91 or 97.9%	93 or 99%	
No Negri bodies found in.....	2 or 2.1%	1 or 1%	

Negative Suspected Cases.

	Hippocampus Major.	Cerebellum.	
No Negri bodies found in.....	26 or 100%	26 or 100%	
Negri bodies found in.....	.....	.....	

In two cases, in which Negri bodies were not found, experimental inoculation in animals proved that rabies was present, but subsequent investigation showed that both of these animals had been killed very early in the disease. In the other cases, in which Negri bodies were absent, the result of animal inoculation was also negative.

PHYSICAL DIAGNOSIS.

BY RICHARD C. CABOT, M.D.,

Instructor in Clinical Medicine in Harvard University, Boston, Mass.

I sincerely hope that this congress and the year 1907 will mark an end of the false and harmful distinction expressed in the title of this address; the distinction, namely, between "laboratory" and "clinical" methods of diagnosis. My first reason for objecting to this distinction is that it is impossible of definition. No one doubts that we apply what are called *clinical* methods of diagnosis to the patients who consult us at our offices or in a hospital dispensary; yet in such cases nothing occurs "at the bedside," because the patient is not in bed. My second objection is that there are many methods which are carried out sometimes at the bedside and sometimes in the laboratory, the difference depending not upon anything inherent in the method employed, but wholly upon extraneous considerations. For example, an examination of fresh blood must be made at or near the bedside; while an examination of stained blood may be made either at the bedside or elsewhere.

Of course it may be said that the distinction is a real one, though not coincident with the literal meaning of the words. It is often supposed that by *laboratory* methods of examination we mean the most *exact* methods, contrasting them with the *rougher* and more approximate processes used at the *bedside*. But this distinction is obviously fallacious, for we have few more exact instrumental methods than the measurement of temperature by means of the clinical thermometer; yet this is often carried out at the bedside, or rather in the bed, (in case the patient is in bed) and not in the laboratory. The measurement of blood pressure by Erlanger's apparatus is a very delicate, difficult and exact method of examination, which (in bedridden patients) must be carried out at the bedside. It is exact, instrumental and clinical; yet it belongs to the type of methods which are often thought of when we speak of "laboratory" diagnosis.

But although the distinction cannot be defined, and does not in fact exist, we *do* attempt sometimes (and most disastrously) to approximate to it. There are physicians who work wholly in the laboratory, and others who never visit the laboratory. The distinction between the "laboratory diagnostician" and the "clinical

diagnostician" is a real but a vicious one. There should be no diagnoses made merely in the laboratory, and none merely at the bedside, unless what are called "laboratory methods" are carried out, as they may be carried out, at the bedside. There should be no diagnoses made without regard to all the essential facts of each case; and there are few cases in which all the essential facts can be attained in the laboratory, and few in which a "bedside" examination suffices.

All that tends to make us build up our diagnosis *at a distance from the patient,* and without the constant reminders of every side of his case given us by his actual presence before our eyes,—all such tendencies, I say, are dangerous. There should be no laboratory practitioners, and no clinicians who do not understand and use "laboratory methods," so called. Instruments, accuracy and common sense are of importance in all types of diagnosis, and of no more importance in any single type than in any other.

The only true division between the kinds of investigation which are carried out upon patients is the division between (a) the work of experimental research, and (b) the work of medical practice. Experimental work, whether in the laboratory or at the bedside, needs a different kind of training, a different mental attitude, sometimes a different standard of accuracy, and above all a different distribution of one's time. Very few men can do both the work of experiment and the work of practical medicine; but every practicing physician should do both what is called "clinical" and what is called "laboratory" work; that is, every man should work both at the bedside and in the laboratory, if he is to do the best for his patients.

II. The Important Distinction Between Exactness of Method and Clearness of Statement in Diagostic Work.

Does physical diagnosis tend towards greater and greater exactness of method? Is the greatest possible exactness desirable in all methods of physical diagnosis? I think not. Exactness, like an umbrella, is sometimes very much in place, and sometimes not. There are methods in use to-day quite uselessly exact, and others in which a greater exactness is very desirable. The degree of accuracy desirable in any diagnostic procedure is governed wholly by the ends to be secured. A pair of scales perfectly adequate

for the weighing of hay, would be far too rough and inaccurate for ascertaining the weight of a patient as it varies from week to week, while the scales used for this latter purpose would be valueless as a chemical balance. Yet, on the other hand, it would do us no good to have a pair of scales by which we could weigh our patients with a degree of accuracy equal to that of a chemical balance, for we could *do nothing with the results* when we got them. We could infer nothing from the slighter variations, and time and money would be wasted in the attempt. When I see statements of blood counts which tell us, for example, that the patient had 5,633 leucocytes to the cubic millimetre, I cannot help making two comments. First, that the degree of accuracy to which the statement pretends is wholly useless; and second, that it is only the *pretence* of accuracy after all. It is pseudo-science and not science. Now if there is one thing which we who try to do scientific work should avoid more than another, it is, I think, this *pseudo-scientific* pretension,—the appearance of accuracy in figures and diagrams, when there is no such accuracy in fact. All blood counts should end with at least two zeros, usually with three.

Another province of diagnostic work in which we have a great deal of the appearance without any of the reality of accurate work is the quantitative estimation of urinary solids. Except in rare cases we can make no use of these figures; they do not tell what they seem to tell, namely, what the kidney is able to do, or what the metabolic processes of the body are accomplishing. The same is true of the quantitative estimations of acidity in gastric contents, as has recently been pointed out by Dr. Charles P. Emerson in his most valuable work on clinical diagnosis. Our quantitative estimations of gastric acidity cannot possibly be more than roughly approximate, owing to the number of disturbing factors whose influence cannot be measured. Hence it is a "fake" to express them in three decimals. There are many other instances in which we have a great deal more of the appearance of accuracy than of the reality, and a great deal more accuracy than we can use even were it real. On the other hand, there are some of our diagnostic methods which are now very much rougher than we wish they were, and where a great degree of exactness is most desirable. For example, the intensity, duration and pitch of heart sounds and breath sounds are data at present appreciable only in the roughest way, and our statements about cardiac and pulmonary diagnosis are

consequently full of lamentably vague terms. Whether to call a given breath sound broncho-vesicular or not, whether we say that a given heart sound is accentuated or not, must often be very arbitrarily decided so long as we have no accurate methods of measuring these sounds.

What, then, is the immortal soul of this passing demand for general increase of accuracy in all places and at all times? It is, I believe, a demand for *clearness of statement.* Clearness of statement in regard to the results of our examinations is always and everywhere desirable; we cannot have too much of it. But this very clearness is often obscured by the use of figures and quantitative terms, which mislead those who hear or read our statements. It is not only vagueness of statement, but the befogging of the sentence with statistics and figures, that obscures our scientific writing. What we want to know from every man is—"Just what did you observe, and just what inference can be legitimately deduced therefrom?" About these matters we cannot be too exact.

III. Two Dominant Tendencies in Physical Diagnosis.

(a.) A tendency beginning to make itself felt in physical diagnosis is that which seeks *directness* of contact with the facts to be studied. Instead of conjectures about the condition of the bladder wall, conjectures based upon the subjective symptoms and upon the analysis of the urine, we are beginning to insist in all doubtful cases upon *direct inspection* of the bladder by means of the cystoscope. Methods of testing the amount of hemoglobin in the blood are more likely to be accurate if they can be carried out without processes involving dilution (and so errors), or contact with chemicals, which may alter the coloring matter in some important respect. If we can compare the color of the blood directly with a standard, we have saved many chances for error. Dilutions and stains are of course necessary in many cases, but they all increase the likelihood of error in our results, and should never be used when more direct methods of examination are possible.

(b.) Another tendency which I think will lead to very important results in the next decade shows itself in the distinction between *functional and anatomical diagnosis,* and in the increased importance attributed to the former. What we want to know is not only (or chiefly) whether or not lesions are present in any organ, but whether they interfere with the function of that organ or other organs, and

if so, how far. Anatomical diagnosis asks:—"How does the organ look and feel?" or "How would it look and feel if we could see and feel it?" Functional diagnosis asks:—"What can the organ do; how useful is it to the body?" Not appearance, but behavior, is more and more our interest. It is not of so much importance to know whether there is enlargement of the inguinal or axillary glands, or of the adenoid tissues of the throat, as whether these enlargements do any harm, interfere with any function. Especially is this distinction of importance in the field of gynaecology. There are a dozen lesions in the adult female pelvis for every genuine interference with function; and the chief business of the diagnostician in this field is to discover what lesions to take seriously and which to disregard, which to treat and which to let alone.

"When you see a head, hit it; when you find a lesion, treat it." Such a maxim governs the practice of far too many physicians to-day. When we find a lesion, we should study with our best care, our best judgment and sense of proportion, all the facts in the case, with special reference to the question—"Shall I treat this lesion, or let it alone?"

IV. The Value of Some Recent Additions to the Technique of Physical Diagnosis.

The title of the subject assigned to me in this discussion bids me attempt an appraisal of the relative value of some of the different methods of physical diagnosis; to that attempt I now turn, choosing as best I can a few out of the many technical processes which might be passed in review.

First, the oldest and simplest methods are still the best, that is, yield the most information useful for the understanding and treatment of disease. Physicians looked at their patients and felt of them, (that is, used "inspection" and "palpitation") long before they practiced any other method of physical examination, and these methods still yield us a far larger bulk of useful information about our patients than any other method. Percussion, although discovered earlier than auscultation, does not, however, as a rule, yield us much valuable information. When we come to the examination of the secretions and excretions of the body, the same statements still hold true: here also inspection yields us the most important information. In nine out of ten cases, as I see them in private practice, I make no examination of the blood other than that

afforded by direct inspection of the color of the blood when soaked into a slip of paper. The visual data about urine, sputa and feces are still the most important. I am excluding here, of course, the data obtained by microscopic examination, which, literally speaking, are also part of inspection, but not part of that ancient and honorable type of inspection which historically precedes all other methods.

Passing now to some of the more recent methods of physical examination on which a judgment may be pronounced, I should say that:—

(a.) The diagnostic value of *fluoroscopy and radiography* are established beyond doubt for all diseases or suspected diseases of bone, and for all diseases in which the presence of concretions is suspected. In such diseases I think it is essential that the patient should have access to a competent practitioner or radiographic technic. On the other hand, I do not regard it as essential, or even of any considerable importance, that every patient suffering from diseases of the heart, lungs or stomach should be examined by the X-ray. Although it is true that X-ray examination occasionally yields us information of great value in diseases of these organs, yet such cases are relatively rare. I do not think that X-ray examination of these organs should become a part of the technic of every up-to-date practitioner.

(b.) The estimation of *blood pressure,* and especially of systolic blood pressure, seems to me also to have proved its value as a part of the routine examination of every case in which disease of the heart, arteries, brain or kidneys is suspected. My reasons for this statement are as follows: We all of us believe that it is of value in diagnosis to estimate the tension of the radial pulse; but it has been abundantly shown by the testimony of many competent observers that even the experienced finger is not infrequently led into wide errors in judging pulse tension. Such errors can be detected only by the use of instruments for measuring blood pressure. It is true that the information obtained by the use of these instruments cannot always be directly utilized for therapeutic purposes, yet its value, although small when compared to that of methods of examination such as inspection, palpation, or urinalysis, is considerable when we take account of the *speed* with which an estimation of systolic blood pressure can be made. The time-factor can never be left out of sight. Relatively time-consuming methods, such as the counting of red blood corpuscles, or the cystoscopic examination of the bladder,

can only be utilized in a comparatively small number of cases where the information to be derived from them is of the greatest importance. On the other hand, blood pressure measurement can be so quickly made that we are justified in using them, and indeed bound to use them, in a large proportion of our cases, even though it is true that the information they afford is relatively slight.

(c.) *Cryoscopy* is not, I believe, of any considerable value in the diagnosis of medical, as contrasted with surgical, disease of the kidneys. It is a time-consuming and difficult procedure, and its results need to be interpreted with so much skill and caution that they do not recompense us for the labor involved.

(d.) The use of *simultaneous tracings taken from the heart and* from one or another of *the peripheral blood vessels,* in the way especially popularized and recommended by MacKenzie, affords a great deal of interesting information, but not, so far as I can see, anything of any considerable value to the practicing physician.

(e.) In the *examination of sputa* we have progressed from the complex to the simple. Reduced to its essentials, sputum work means to-day a good look at the sputa in bulk, the judicious use of one's nose and the search for tubercle bacilli. Curschmann's spirals, Charcot Leyden crystals, fibronous casts, influenza bacilli yield us no clues for diagnosis, prognosis, or treatment.

(f.) To *immerse the patient in a warm bath during palpation of the belly* is a procedure which recommends itself, I think, more and more to those who have given it a trial. The muscular relaxation which is produced in some difficult cases is such as to render an ether examination unnecessary.

Summary and Conclusions.

1. The attempted distinction between laboratory methods and clinical methods of diagnosis is a false and misleading one. The attempt should be abandoned once for all.

2. The degree of exactness desirable in any technical procedure depends wholly on the end to be secured. We may easily have too much as well as too little exactness. But we cannot have too much clearness in the expression of our results.

3. Modern physical diagnosis shows (among others) two dominant tendencies: (a) To seek for and prize the most direct methods of examination; (b) to lay stress upon the present functional

capacity of an organ, rather than upon the presence and appearance of anatomical lesions.

4. The oldest methods—inspection and palpation—are still the best. Among recent additions to our technical resources three (among others) may be mentioned as likely to stand the test of time. They are (a) X-ray examination; (b) blood pressure measurements; (c) palpation of the abdomen beneath the surface of a warm bath.

Discussion.

Dr. Geo. Blumer: I agree with Dr. Cabot that the laboratory and clinical methods of diagnosis can not be separated; there should be no distinction between laboratory and clinical methods. Every physician should have a careful training in both. The ideal condition would be for every physician to be able not only to examine his patient clinically, but to carry out accurate laboratory examinations. Unfortunately, however, at present the vast majority of physicians are not able to make the more complicated laboratory examinations, and in order to reach that ideal state it will be necessary to change our methods of training medical students, and to give a great deal more attention to the practical and laboratory side of medicine than is done at present in most medical schools. All we can hope to do, for the present, is to teach the student how to do the simpler tests, and how to interpret the results of the examinations of the laboratory experts in the case of the more complicated procedures. The clinical methods are now of more value to the majority of physicians than the laboratory methods, and the ordinary physician, without special laboratory training, will in most cases reach more accurate results by cultivating his powers of clinical observation. It is true, however, that the average physician is capable of interpreting the more simple urinary and blood tests, and Dr. Cabot's views as regards the value of urinary examinations, while containing truth, err decidedly on the side of pessimism in my opinion. It is to be feared that under present conditions the over-emphasis on laboratory work for clinical purposes has tended to make us negligent as to accurate clinical observation. Both forms of observation are of the greatest value, but correlation is necessary.

THE COMPARATIVE VALUE OF THE MEDICAL AND SURGICAL TREATMENT OF THE IMMEDIATE AND REMOTE RESULTS OF ULCER OF THE STOMACH.

THE MEDICAL VS. SURGICAL TREATMENT OF GASTRIC ULCER.

BY J. H. MUSSER, M.D.

Professor of Clinical Medicine in the University of Pennsylvania, Philadelphia.

The last word concerning the treatment of gastric ulcer has not and cannot be said, for the following reason, although individuals with large experience may give reasonably mature conclusions. The cases reported are meagre, particularly as to the after-history of the cases. The medical and the surgical reports are equally culpable. The latter may be excused because the time since operative procedures have been instituted has been so recent the after-history is not of value. Technique and operative mortality have concerned the surgeon chiefly. Indeed, the former has so recently been fixed upon with any uniformity that the essential end-results could not be calculated. Fortunately, the time is approaching when definite conclusions can be drawn.

The difficulties attendant upon a solution of the best methods for the treatment of gastric ulcer are great. The uncertainty of its clinical course renders statistics concerning therapy most confusing and often unreliable. It is often present without symptoms; its most active manifestations may be followed by a period of quiescence; it may recur at varying intervals; it may remain a mild disease, large groups being attended by minimum mortality; or it may be a grave affection, vicious to the extreme.[1] There is, or may be ever present, that general nervous state or nutritional fault which precedes, attends and therefore invites recurrence of ulcer.

In a general way the methods of treatment are either medical or surgical. At least it has been forced on the minds of the profession that gastric ulcer must be considered either a medical or a surgical disease. This attitude is such, that notwithstanding the

[1] A physician of large experience in hospital and private practice writes he has never seen a death from gastric ulcer and never sent a patient to a surgeon. His experience of gastric ulcer was not large, it is fair to say.

ERRATA.—Attention is called to unfortunate errors of the percentages in the tables herewith re-printed from the article on Gastric Ulcer, etc., in the *Proceedings of the Congress of Physicians and Surgeons*, 1907. Kindly make a note of these corrections in your copy of the "Proceedings." J. H. MUSSER.

TABLE I.—FREQUENCY OF GASTRIC ULCER, BASED ON CLINICAL OBSERVATION.

Author.	No. of Cases.	No. of Gastric Cases.	No. of cases of Ulcers.	Private Practice.	Per cent.
Lebert	41,688	....	252	....	0.6
Charité Hospital, Berlin, 1888–1898	42,219	....	555	....	1.33
Howard[1]	(Med. adm.) 161,599	....	930	....	0.56
Fenwick[2]	(Med. adm.) 45,712	....	383	....	0.83
	Out-patients 5,000	....	37	....	.74
Bramwell[3]	In-patients 35,692	....	803	....	2.2
	Out-patients 7,665	....	76	....	0.9
Medical Service of Bell. Hospital Harlow Brooks	In 3 mos. 6,205	....	3	....	0.04
Berlin, Charité	1903–04 15,834	250	46	....	0.22
	1904–05 15,863	279	48	....	0.3
Clayton[4]	1,869	108	8	....	0.4
Elsner	1,000	171	14	Private	1.4
Ingers	2,105	550	7	Private	0.33
Lichty	6,870	1,269	103	Private	1.4
Friedenwald	13,794	....	287	Private	2.0
Sawyer	....	1,800	63	Private	

[1] Hospitals of U. S. (15). [2] London and Temperance Hospitals. [3] Edinburgh Royal Infirmary. [4] Garfield Hospital.

TABLE II.—FREQUENCY OF GASTRIC ULCER BASED ON AUTOPSY.

Author.	No. of Autopsies.	No. of Gastric Ulcers.	Per cent.
Welch (German Statistics)	32,052	1,522	4.7
Dietrich	10,103	350	3.4
Fenwick	47,912	2,019	4.2
Harlow Brooks (Bellevue Hospital)	1,000	9	0.9
Pearce (Albany Hospital)	1,000	11	1.1
Welch (Bellevue Hospital)	800	6	.75
Willigde	3,440	221	6.4
Howard (Hospital of U. S.)	10,841	144	1.32
Francine (Philadelphia and Phipps)	2,937	41 Duod. & gastric	1.3
German Hospital (A. O. J. Kelly)	937 (11 years)	13	1.3
Mallory (Boston City Hospital)	2,600	25	0.9
Warthin	200	7	3.5
Schneider (Munich)	1895–1899 4,535	89	1.74

TABLE VII.—PERCENTAGES OF SIMPLE ULCER, SEQUELAE, HEMORRHAGE, PERFORATION IN CASES COLLECTED FROM LITERATURE.

Total number of cases 1871:

Numbers of cases perforation	536	28.6	per cent.
Number of cases hemorrhage[1]	160	8.5	"
Number of cases simple[2]	409	21.3	"
Number of cases sequelae	766	40.9	"
	1871		

[1] Demanding treatment. [2] Without serious hemorrhage or sequelae.

protests of good surgeons, cases are forced upon them for operation when it would be unjustifiable to operate.

To combat this notion it seems necessary to assume that there are two forms of treatment; to demonstrate if possible their relative values; to show that each has a field and also in which field the respective methods apply. In one sense no comparison can be made. Gastric ulcer has two phases; one of simple course; the other, with complications. These are the divisions held to in this paper—simple ulcer and ulcer with complications. The simple and the complicated phase have an entirely different clinical expression, although both are liable to the accidents of hemorrhage and perforation.

Any form of successful treatment should lower the mortality of the disease, should aim to cure it so thoroughly that, as far as can be said, the ulcer is healed and that danger of relapse is not likely to occur, and that the patient is in as good condition relatively as before the onset of the affection.

Any procedure which brings about such an ideal condition is of course the one to adopt. It is the purpose of the statistics which follow to show which form may more nearly attain this end. The problem is rendered difficult because the disease is not common and the experience of individual observers is small.

The Criteria of Cure.

What constitutes a cure? The statistics of gastric ulcer show that most observers consider the disease cured when after three or four weeks of treatment the symptoms are relieved or removed. This is unfortunate. No value can be attached to cases reported in such manner. It is well known that at varying intervals after an alleged cure, perforation or hemorrhage may occur. To establish criteria on which to base a cure is difficult. It would seem that a lapse of two years without symptoms, that an approach at least to normal chemical conditions and a removal of all abnormal physical or mechanical states are sufficient grounds to affirm that a cure has taken place in simple ulcer. To these some authorities would add the absence of occult blood from the stools for a long period.

After a course of treatment by any means, notwithstanding these precautions, it is difficult to say a cure has been obtained unless all the above conditions have been fulfilled.

The Advantage of Medical Treatment.

The two forms of treatment held out to us have advantages and disadvantages. By the medical treatment the functional derangements, causal and secondary, are managed. It is conducted without doing violence to the body in any way and if successful leaves the subject in as good condition as before.

The Dangers of Medical Treatment.

A sense of false security is given as the ulcer may be dormant and an accidental and fatal complication arise when not prepared for it. The freedom from symptoms may flatter the patient a cure has been established and induce carelessness in dietetics, hygiene, etc. Further, that the healing of the ulcer, also possible in the surgical treatment, may be attended by the grave sequelae of adhesions, contractions or stenosis.

The Advantage of Surgical Treatment.

By the surgical treatment, if indicated, the advantages of the medicinal treatment are secured. The operation is too often held to be the panacea, when success is really due to the after-cure. There is no reason why a patient who has undergone surgical treatment should not have an after-treatment like that which is given to cure the tendency to ulcer. The advantages depend upon the nature of the operation and the ability to deal with the complications. If the operation of excision is resorted to, the symptoms and accidents are prevented, providing of course there is only one ulcer. The gastro-enterostomy now in vogue is a procedure which, while it relieves the many symptoms, does not warrant the belief that a cure is established. It is not proven that the ulcer has healed. Both perforation and hemorrhage occur after gastro-enterostomy. It is not known that relapse or recurrence is less frequent than in ulcers treated medically. The splendid statistics of Robson and of Mayo in their end-results compare favorably but are not better than similar statistics of men who have treated similar groups of cases medically. The time element in the surgical cases is the unsettled factor as yet. If the ulcer is excised, a dangerous and not practical procedure we are told, or destroyed by perforation, the only risk comes from persistence of the organic cause or the presence of two or more ulcers. In the second period of ulceration, when complications have arisen, the advantages are entirely in favor of surgery.

The Dangers of Surgical Treatment.

1. The same as in the medical treatment unless excision of the ulcer, if solitary, is resorted to.

2. Operative death.

3. Death from complications.

4. Death or ill health from defects in metabolism.

5. The effect of the operation. The patient on whom an operation has been performed has the disadvantage of a psychic insult, the influence of which is not trifling, and of being in possession of new physical and physiological conditions the nature of which time alone can tell. It must be admitted, a patient who has undergone a grave surgical operation is not in as good condition to have that indefinable something, which may be termed neurosis, cured as he who has not been submitted to such an insult.

The surgical dangers are constantly lessening. From an average operative mortality of 20 per cent. they have fallen to 1½ to 2 per cent. for individual operators and 10 per cent. for all. The tables will show a remarkable change borne of experience in technique between the operative results of all prominent operators in their first and their latest series.

Thus the vicious circle is rarely established and in the latest large group of the Mayos, Moynihan, Robson, Deaver and others it did not occur. Peptic jejunal ulcer is also a less frequent complication (see Lyle and Joslin).

Hunsheimer, Joslin, Rosenberg, Kreuger and others have studied the effects of gastro-enterostomy on metabolism and on gastric secretion. The studies are not sufficient as to the metabolism although most suggestive. More studies must be made also of the chemical secretions. Kreuzer's are the most recent. (Effects of gastro-enterostomy on chemical functions of the stomach. Kreuzer, 1906.)

The after effects of gastro-enterostomy are, he states:

1. Secretory function again assumes normal condition.

2. Total accidity falls to normal—sometimes below, but rises shortly to normal. If the acidity was above normal before operation it sinks otherwise to normal. If acidity was diminished the usual rule is for it to reach normal or slightly above.

3. Free hydrochloric acid—usually lessened after operation.

4. In those cases where no trace of hydrochloric acid is found, it is obtainable after the operation, the exception being to find it

missing. A deficient hydrochloric acid cannot be considered a disadvantage as it is only a result of increased emptying power of the stomach.

5. The backflow of bile into the stomach disappears gradually and does not seem to cause any pronounced symptoms.

6. Backflow of pancreatic juice is seldom recognizable. Complete blocking of outflow seems to be more the result of the disease than of the operation.

Katzenstein studied the question experimentally and compels us to assume that the secretory in addition to the motor function is benefited by operation. Not only did he find that the backflow of bile and pancreatic juice lowered the acidity because of this alkalinity, but also that the delicate reflexes of the duodenum and jejunum were not lost, if the animal was fed on special foods, as fats.

The experimental evidence does not forbid surgical procedures, apparently.

A study of statistics, to one who has had the opportunity of studying only some sixty odd cases of gastric ulcer, the wisdom that comes from personal experience cannot be overwhelming. The study here presented is based, therefore, on an analysis of 1,871 cases of gastric ulcer and 316 cases of duodenal ulcer collected from the accumulated literature since 1897.[1] The cases selected are those only which have been reported in full detail.

The German and French cases[2] were tabulated in accordance with the following scheme:

1, Age. 2, Sex. 3, Hemorrhage. 4, Pain. 5, Vomiting. 6, Boas' tender points. 7, Acidity. 8, Feces. 9, Retention. 10, Duration of Diseases. 11, Treatment medical. 12, Result. 13, Treatment surgical. 14, Result. 15, Length of period under observation after treatment. 16, Recurrence. 17, Remarks. 18, Observer.

The English and American cases, on the other hand, have been analysed to determine the incidence of age and sex; the basis for diagnosis according to symptoms and gastric analyses; the occurrence of retention from simple dilatation, pyloric spasm, adhesions, hourglass contraction or pyloric obstruction; the duration of the disease; the medical treatment, if any, and the result; the surgical treatment, if any, and the result; the duration of relief; the

[1] The cases of duodenal ulcer have been reserved for a future communication.

[2] Over 900 cures. Treatment only analyzed in this communication.

recurrence. The question of hyperacidity or hyperchlorhydria was, through an oversight, omitted. This is to be regretted as the division of ulcers into those with secretory symptoms and those with motor symptoms should be clearly defined. Fortunately the answers to the various questions are such that in a general way this question has been satisfactorily met.

In addition a study of 586 cases has been made, based upon private communications received in reply to a letter to members of the Society which requested an answer which would supply the above facts.

I scarcely need say I am deeply indebted for the valuable contributions thus placed at my disposal.[1]

I have kept apart from my tables and used as control, for analysis and comparison, the unique and unparalleled experience of the Mayos and of Robson, Moynihan, Munro, v. Mikulicz, and many others, as well as of the distinguished gentlemen who took part in the discussions of the Royal Medical and Chirurgical Society in 1906. No papers on gastric ulcer can be written without drawing fully on the older writings and the not remote ones of Welch, Fenwick, Lebert, Dreschfeld, Brinton and others.

To control the errors, liable to occur in statistics, comparisons have also been made with the conclusions of the various able writers who have analyzed large groups of cases. The skillful analyses of Wier and Ford, Rodman, Patterson, Caird, Russell, Bramwell, Greenough and Joslin; of Lund, Joslin and Murphy; of Sears, Campbell Howard, Thompson and others are invaluable. The German and French theses and the papers of Brunner, Kreuzer, Krönlein, Körte, v. Mikulicz, Minkowski, Blumensath, Spicker, Schneider, Becker, Ladevèze and Rochard have also been excellent controls.

The well founded objection that statistics which give the results of treatment are usually exaggerated, whether surgical or medical, because the tendency to omit failures is dominant, has been borne in mind. It does not appear, however, that there is any other way of bringing together a large number of cases except by this means.

The statistics offered by the advocates of medical treatment do not fully prove their case. A better brief could be made by them had the cases been reported in greater detail and especially, also,

[1] Since this has been written, valuable private communications with lists of cases have been sent me by Deavir and others. They will be embodied in an analysis in the future.

with more precise accounts of after-results. It must be said in this respect that the surgeons have their cases better in hand for continued observation. This has grown out of the necessity before them of continually proving the contention that their invasion of the sphere of medicine is warranted by results. The quarrel as to the respective merits of the medical and surgical treatment of appendicitis would be in continuance had the surgeons not been able to marshal their facts to telling purpose. Then, too, the responsibility of taking the life of the patient in their hands, adds to the necessity of scientific precision of knowledge instead of glittering generalities.

The study of statistics impresses one with the value of having a single guiding head and hand for each department of a hospital and of a liberal management which will employ such aid as can enable the staff to properly collect records and to keep in touch with patients after their discharge. An efficient medical secretary is as essential as a good nurse in any institution. Only by these means can fruitful observation be secured. Moreover, although it places another burden on the practitioner, if he wishes to attain knowledge that can be applied to his daily work, he must similarly keep in touch with patients after their discharge.

As previously intimated statistics are thus far not reliable, and can only admit of approximate conclusions because no established criteria have been formed for a basis of calculation. They are meagre because the patients are lost sight of. From the studies of the many cases in the literature I should say we need information of the end-results and the course of the disease during a period of ten years. We should agree upon what constitutes a "cure." All realize the difficulties, whether it is to base the result on the duration of relief to symptoms and the absence of physical sequelae or on the plan of Boas, to affirm a cure only when occult blood (in addition to the above) is absent from the stools.

The study has not been satisfactory, for the reasons above mentioned. It has been profitable because it has laid bare our deficiencies. Many points of interest are brought out, and the province of the physician and surgeon defined.

Some elementary facts obtained from a study of the statistics of gastric ulcer must be known to estimate the relative merits of remedial measures. We should have a clear notion of the frequency of gastric ulcer, of the mortality of the disease, irrespective of treatment, and of the mortality of the surgical and the medical treatment of the affection.

The Frequency of Gastric Ulcer.

The infrequency of this affection, as the following statistics will show, behooves us to pause before urging operative procedures for intractable indigestion, haematemesis, gastric pain and other isolated symptoms on the ground that they are of ulcer origin. I am willing to admit an exploratory operation in competent hands is attended by very little danger. If the surgeon wishes to coddle his mental powers by employing this means of diagnosis and the patient is willing to submit, nothing more need be said. Otherwise, gastric ulcer will not be considered a frequent surgical affection. This is surely the case in simple ulcer. It would be infrequent in complicated ulcer, if the simple were treated over a sufficiently long period of time.

TABLE I.—FREQUENCY OF GASTRIC ULCER, BASED ON CLINICAL OBSERVATION.

Author.	No. of cases.	No. of Gastric Cases.	No. of cases of Ulcers.	Private Practice.	Per cent.
Lebert	41,688	....	252	....	0.64
Charité Hospital, Berlin, 1888–1898	42,219	....	555	....	1.33
Howard[1]	(Med. adm.) 161,599	....	930	....	.57
Fenwick[2]	(Med. adm.) 45,712	....	383	....	0.82
	Out-patients 5,000	....	37	....	.74
Bramwell[3]	In-patients 35,692	....	803	....	2.2
	Out-patients 7,665	....	76	....	0.09
Medical Service of Bell. Hospital Harlow Brooks	In 3 mos. 6,205	....	3	....	.004
Berlin, Charité	1903–04 15,834	250	46	....	.0022
	1904–05 15,863	279	48	....	.003
Clayton[4]	1,869	108	8	....	.004
Elsner	1,000	171	14	Private	1.5
Ingers	2,105	550	7	Private	0.03
Lichty	6,870	1,269	103	Private	1.4
Friedenwald	13,794	....	287	Private	2.0
Sawyer	....	1,800	63	Private	

[1] Hospitals of U. S. (15). [2] London and Temperance Hospitals. [3] Edinburgh Royal Infirmary. [4] Garfield Hospital.

TABLE II.—FREQUENCY OF GASTRIC ULCER BASED ON AUTOPSY.

Author.	No. of Autopsies.	No. of Gastric Ulcers.	Per cent.
Welch (German Statistics)	32,052	1,522	5.0
Dietrich	10,103	350	3.4
Fenwick	47,912	2,019	4.2
Harlow Brooks (Bellevue Hospital)	1,000	9	0.9
Pearce (Albany Hospital)	1,000	11	1.1
Welch (Bellevue Hospital)	800	6	.75
Willigde	3,440	221	.64
Howard (Hospitals of U. S.)	10,841	144	1.32
Francine (Philadelphia and Phipps)	2,937	41	.13
German Hospital (A. O. J. Kelly)	937 (11 years)	Duod. & gastric 13	.13
Mallory (Boston City Hospital)	2,600	25	0.9
Warthin	200	7	.35
Schneider (Munich)	1895–1899 4,535	89	1.92

Howard in a valuable paper pointed out that the frequency of ulcer varied in different cities—based on clinical returns he found the largest percentage of cases, Boston 1.28; smallest number, Denver 0.12. The Boston statistics tallied well with the figures of Greenough and Joslin from the Massachusetts General Hospital, where a percentage of 1.74 was found. It is of interest to note that in Breslau and Zurich 0.66 per cent., London 0.78 per cent., Berlin 1.33 per cent., Edinburgh 2.2 per cent., are fair estimates of the clinical frequency of gastric ulcer. The percentage of frequency in America is greater than that in Germany and London. Edinburgh is higher than America or London.

The variation in statistics in hospitals of the same city is due to the different class of patients admitted to the respective hospitals. It is well known that the death rate and frequency are higher in Guy's Hospital in London than in other hospitals, because of the poor class of patients admitted to the former.

In private communications received from physicians throughout the country the reports of the infrequency of gastric ulcer in the cities mentioned above is confirmed. It must not be forgotten, however, that different observers have different criteria upon which the diagnosis of ulcer is based. Thus Howard states that the disease is rare in Baltimore, whereas Friedenwald reports an unusually high percentage. Professor Baumgarten in St. Louis writes it is very infrequent and that he has never had to send a case to a surgeon.

The Mortality.

The mortality of gastric ulcer varies with different observers, as the tables to follow indicate. Irrespective of the method of treatment, the mortality of patients admitted to the hospital seems to be from 6 to 8 per cent., although Bulstrode places it as high as 18 per cent. and Gilman Thompson 20 per cent.

In private practice the mortality is much less as the cases of Friedenwald, Lichty and others show.

Table III.—Mortality of Gastric Ulcer.

Medical Treatment.

Osler	8·6	per cent.
Schulz	10.5	"
Leube	2.2	"
Ekke	2.1	"
Köhler	6.4	"
Rujel	8.10	"
Warren	10	"
Welch	15	"
Stoll	22	"
Schulz (1903)	5.5	"
Friedenwald	1	"
Gilman-Thompson	20.5	"
Sears	7.4	"
Russell	2.1	"
Bulstrode	18	"
Bramwell	6.2	"
Greenough and Joslin	8	"
Robinson	1.7	"
Becker	2.1	"
Lenhartz	2.2	"

Table IV.—Mortality of Simple and Complicated Gastric Ulcer—Surgical.

Krönlein	15.3	per cent.
Czemey	13.6	"
Carle and Fantino	19.0	"
Kümmell	19.0	"
Körte and Herzfeld	25.9	"
Kaiser	0	"
Rydygier	18.5	"
Schlosfer	11.7	"
Küster	20.0	"
Kreuzer (from Krönlein clinic)	15.3	"
Tricomi (1899)	10	"
M. Robson (1900)	17.7	"
Wolfler (1896)	21	"
Körte and Herzfeld	20.25	" (mean)
Mikulicz (to 1897)	13.9	"
Kreuzer	21.8	"

TABLE V.—MORTALITY FOR SIMPLE ULCER.—SURGICAL.

Tricomi (1899)	10	per cent
M. Robson (1900)	17.7	"
Carle Fantino	6.9	"
Kausch (Mikulicz)	5.9	"
Petersen and Machol (Czemey)	4.8	"
Stich	9.5	"
Robson (all statistics)	5.	"
Krönlin	13.7	"
Krönlin (1904)	8.1	"
Moynihan (1906)	0.8	"

TABLE VI.—MORTALITY IRRESPECTIVE OF NATURE OF OPERATION, SIMPLE AND COMPLICATED—SURGICAL.

Mikulicz	16.1	per cent.
Mayo Robson	16.4	"
Mayo Robson (one year later)	5.0	"
Moynihan (1905)	1.3	"
Mayo	6	"
Miruro	20	"
Petersen and Machol	11	"
Waterhouse	6.4	"
Joslin	23.8	"
Moynihan (1906) (hem., stenosis, etc.)	3.5	"
Mayo Robson (1906)	1.7	"
Hawkins	19.3	"

TABLE VII.—PERCENTAGES OF SIMPLE ULCER, SEQUELAE, HEMORRHAGE, PERFORATION IN CASES COLLECTED FROM LITERATURE.

Total number of cases 1871:			
Number of cases perforation	536	28.1	per cent.
Number of cases hemorrhage[1]	160	8.01	"
Number of cases simple[2]	409	21	"
Number of cases sequelae	766	40.01	"
	1871		

The number of reported cases of simple ulcer included in the analysis is undoubtedly very small. As no special interest is attached to single cases treated medically, they are not reported. Moreover, the proportion of cases is not true. Thus, cases of perforation have been reported more frequently of late, to clear up questions of diagnosis and settle modes of surgical technique. The following table of unpublished cases from private practice gives a truer idea of the relations of the simple and complicated ulcer and the frequency of the grave accidents, in various forms:

[1] Demanding treatment. [2] Without serious hemorrhage or sequelae.

TABLE VIII.—PERCENTAGES OF SIMPLE ULCER, SEQUELAE, HEMORRHAGE, PERFORATION IN UNPUBLISHED CASES.

Simple ulcer	194	33.1 per cent.
Hemorrhage (grave)	23	3.9 "
Perforation	16	2.7 "
Sequelae	353	60.2 "
Total	586	

Simple Ulcer. Table IX. shows the result of the treatment of simple ulcer. The mortality is 17.3 per cent. It is seen that the advantage is in favor of medical treatment, as the immediate result from such treatment is attended by a mortality of 12.4 per cent., while by surgical treatment it is 20 per cent.

We must admit, physician and surgeon alike, simple uncomplicated ulcer is a medical disease.

This does not include the statistics of Leube, Lichty and many others. Hemorrhage and perforation cases are not included. Thus Leube and Friedenwald have, and Bramwell, Schultz and Robinson estimate, a mortality below 6 per cent. Without doubt the excellent results attained in private practice are explained by the fact that the cases apply early for treatment, at once are placed on a proper dietary, and medical supervision is continued for a long time. It must be remembered that hospital cases, presumably the poorer classes, have more frequent complications and sequelae and a higher mortality than private cases. This occurs because the former class cannot carry out treatment for a sufficiently long time and, indeed, usually give it up as soon as symptoms are relieved.

TABLE IX.—RESULT OF TREATMENT IN SIMPLE ULCER OF CASES COLLECTED FROM LITERATURE.

Simple uncomplicated ulcer. 409 cases				21	per cent.	
Cure and improvement				76	"	
Male..... 143 34.9 p. c.		Unimproved		6.6	"	
Female ..... 266 65.1 "		Death.....		17.3	"	
Immediate result.	Surgical treatment,	Cure	184	68.1 p. c.	} 73.2 p. c.	
		Improved ..	41	5.1 "		
		Unimproved	18	6.6 "	} 26.6 p. c.	
		Death.....	54	20.0 "		
Immediate result.	Medical.	Cure.....	102	73.3 "	} 81.2 p. c.	
		Improved ..	11	7.9 "		
		Unimproved	9	6.4 "	} 18.4 p. c.	
		Death.....	17	12.4 "		

TABLE X.—SIMPLE ULCER. UNPUBLISHED CASES.

Simple ulcer.	Total number of cases.....		194		
	Male.....		56	28.9%	
	Female		138	71.1	
35 Surgical treatment	18. %	Cure ...	85.7%	Unimp. ..	14.3%
159 Medical treatment	82.	Cure ...	91.7	Unimp. ..	8.3
As to decade of surgical treatment, most cases between 20–30					
	48.5%	Men....	29.49%	Women ..	70.6%
Of these cure ...	94.1	Men....	29.4	Women ..	70.6
unimp..	5.9	Women. 100 (one case).			
As to decade of medical treatment most cases between 20–30					
	48.4%	Men....	20.5%	Women ..	79.5%
Of these cure ...	91.	Men....	17.9	Women ..	82.1
unimp..	9.	Men....	28.5	Women ..	71.5

In Table X. the result of treatment of simple ulcer in private practice is given. A closer analysis shows that of the 85.7 per cent. that were noted as cured by surgical treatment 77.1 per cent. were reported as cured finally and 8.5 per cent. improved. Of the 14.3 per cent. unimproved 11.4 per cent. died. 91.7 per cent. were reported as cured by medical means, of which 60.1 per cent. were cured absolutely and 32 per cent. improved. 5 per cent. of the unimproved remained ill and 3.1 per cent. died.

The death rate in simple uncomplicated ulcer treated surgically is higher (11.4 per cent.) than the death rate of cases treated medically (3.1 per cent.). It must be observed, however, that a larger number were reported "improved," after medical treatment, the end of which is not known, than by surgical means.

TABLE XI.—SURGICAL TREATMENT OF SIMPLE ULCER. LITERATURE. TOTAL NUMBER 270.

Arranged according to Decades.

	Cure.		Improved.		Unimproved.		Death	
Age.	M.	F.	M.	F.	M.	F.	M.	F.
10–20	3	2	0	1	0	2	1	2
20–30	8	35	0	2	2	6	3	2
30–40	21	27	3	3	0	2	3	14
40–50	33	23	1	3	3	0	6	7
50–60	6	9	1	0	0	1	9	3
60–70	6	3	0	0	0	1	0	2
70	0	0	0	0	0	0	0	0
Not given	2	6	0	0	0	1	0	2
Total	79	105	5	9	5	13	22	32
	68.1%		5.1%		6.6%		20%	

Tables No. XI., XII., XIII. show the decades in which treatment was resorted to.

It is seen that the cases came to the surgeon after the thirtieth year and the larger proportion in the decade 40–50. Male subjects deferred treatment to a later period than females.

TABLE XII.—MEDICAL TREATMRNT OF SIMPLE ULCER. LITERATURE. 139.

Arranged according to Decades.

	Cure.		Improved.		Unimproved.		Death.	
Age.	M.	F.	M.	F.	M.	F.	M.	F.
10–20	2	16	0	1	0	0	0	3
20–30	8	35	2	1	2	1	3	4
30–40	5	14	1	2	0	2	1	0
40–50	7	8	1	1	1	1	0	1
50–60	2	1	0	2	0	2	1	1
60–70	1	0	0	0	0	0	1	1
70	1	0	0	0	0	0	0	0
Not given	2	0	0	0	0	0	1	0
Total	28	74	4	7	3	6	7	10
	73.3%		7.9%		6.4%		12.4%	

Cases are treated medically in the earlier decades. They are in all probability uncomplicated. The surgeon is brought to the complicated cases, as Table XI. would seem to indicate. Either one of two things is evident, cases are not sufficiently grave to undergo treatment, or medical treatment is not conducted as vigorously and over as long a period of time as required to bring about a cure. It is more likely the early symptoms were absent, mild, or overlooked and treatment was not needed until organic conditions developed. The following, Table XIII., shows the decades in which treatment in private practice is resorted to. In these cases the surgical treatment was instituted with the same relative degree of frequency as the medical in the corresponding decades. The number is not large, and hence percentages are not calculated. The tables show that the reported or hospital cases (poorer classes) delay any kind of treatment and that the more severe cases go to the surgeon. In private practice there is not the same delay.

The tables (XI. and XII.) show a higher percentage of cures by medical than by surgical means, bearing out the results of analysis of the same cases in tables IX. and X.

TABLE XIII.—SURGICAL TREATMENT OF SIMPLE ULCER. UNPUBLISHED CASES IN WHICH AGE AND SEX ARE GIVEN.

Age.	Cured. M.	Cured. F.	Improved. M.	Improved. F.	Unimproved. M.	Unimproved. F.	Death. M.	Death. F.
10–20	..	1	..	..	..	..	..	..
20–30	4	11	1	..	..	..	..	1
30–40	3	2	..	1	1	..	2	..
40–50	1	2	..	..	..	..	..	1
50–60	1	..	..	..	..	..	..	..
60–70	1	..	..	..	..	..	..	..
	77.1%		8.4%		2.8%		11.2%	

Medical Treatment of Simple Ulcer. Age and Sex.

Age.	Cured. M.	Cured. F.	Improved. M.	Improved. F.	Unimproved. M.	Unimproved. F.	Death. M.	Death. F.
10–20	1	16	..	1	..	..	..	..
20–30	8	33	6	24	2	3	..	2
30–40	6	12	4	10	..	1	..	1
40–50	3	10	1	1	..	..	..	1
50–60	..	6	3	1	2	..	1	..
60–70	2	..	..	..	..	..	..	..
	60.3%		31.4%		3.3%		3.17%	

In simple ulcer the death rate under surgical treatment was 20 per cent. and under medical treatment 12.4 per cent. Privately reported cases showed a surgical mortality of 11.4 per cent. and a medical mortality of 3.1 per cent. It is not easy to compare these statistics with others, for in other analyses the mortality is given both of simple and complicated ulcer when not due to hemorrhage or perforation. The results of the medical treatment of peptic ulcer in the Boston City Hospital as reported by Sears showed a mortality of 21 per cent. Greenough and Joslin in a study of 187 cases treated in the Massachusetts General Hospital found the mortality was 8 per cent. It must be noted only 40 per cent. of the 82 per cent. discharged cured or relieved remained well. The series which Schultz analyzed from the Breslau and new Hamburg Hospitals gave a mortality of 5.4 per cent., or if unrelieved and died are added, of 10.5 per cent. unimproved by treatment. Sears well points out that the longer cases are followed the higher the proportion of failures, rising at the end of five years to 50 per cent. Unfortunately neither surgical nor medical cases have been observed over the length of period that permits of definite conclusions. Gradually there comes to light more and more cases in which repeated operations were done indicating failure by surgical as well as by medical means. Hewes reports a series of cases of simple ulcer

which more nearly correspond to our groups. Of 51 cases immediate results with complete relief followed medical treatment in 48; failure in relief of symptoms 2; died 1. Forty-nine of the 51 were followed for a period of two years with results as follows: 31, or 63 per cent. cured; 18, or 36 per cent. recurred; 1, or 2 per cent. died. The same class of cases treated surgically, 13 in number, resulted as follows: cured 6, or 46 per cent.; recurred or not relieved by operation 3, or 23 per cent.; died shortly after operation 4, or 30 per cent. A separation of the cases into the simple and complicated cases was not made in B. Robinson's cases (mortality 2.1 per cent.); in Bramwell's (mortality 6.2 per cent.); in Russell's (mortality 2.1 per cent.); and Von Leube's (mortality 2.4 per cent.); all of which were treated medically. Had such been the case the mortality for the management of simple ulcer would have been less without doubt.

TABLE XIV.—REMOTE RESULTS OF SURGICAL AND MEDICAL TREATMENT OF SIMPLE ULCER. LITERATURE.

Period.	Simple Ulcer, Medical. Cure.	Imp.	Unimp.	Death.	Simple Ulcer, Surgical. Cure.	Imp.	Unimp.	Death.
6 m.	20	10	2	11	36	5	4	47
6–12	3	0	0	0	28	1	0	0
1–2	0	0	0	0	43	0	0	0
2–3	0	0	0	0	6	0	0	0
3–4	1	0	0	0	12	1	0	0
4–5	0	0	0	0	1	1	0	0
5	1	0	0	0	4	0	0	0
Not given	85	..	5	..	..	109	4	..

This table shows the result from six months to five years after treatment. It shows also the unsatisfactory state of the literature, inasmuch as end-results are disregaded by surgeons and clinicians alike. Nevertheless, of 270 cases treated surgically, presumably cured, 47 were dead at the end of six months, while of 139 treated medically eleven died in first six months.

TABLE XV.—REMOTE RESULT OF SURGICAL TREATMENT OF SIMPLE ULCER. UNPUBLISHED CASES.

Surgical.

Period.	Cured.	Improved.	Unimproved.	Death.
1–6 mos.	2	..	..	4
6–12 "	2	..	..	..
1–2 yrs.	..	..	..	..
2–3 "	..	..	..	..
3–4 "	..	..	..	..
4–5 "	..	..	..	..
Over 5 yrs.	..	..	..	..
Not given	18	1	..	..

Recurrence noted in 2 cases.

Medical.

Period.	Cured.	Improved.	Unimproved.	Death.
1–6 mos.	6	6	1	5
6–12 "	9	3	..	..
1–2 yrs.	4	2	..	..
2–3 "	7	..	..	..
3–4 "	..	1	..	..
4–5 "	..	..	..	..
Over 5 yrs.	1	..	..	..
Not given	58	36	6	..

In addition to the cases of Table XV. the records show 35 cases apparently cured but followed by recurrences. Of these 29 showed benefit after further treatment. Of the cases treated medically recurrence was noted in 16 apparent cures. Although the period of observation was not given, all but 14 were observed for periods extending beyond six months.

The remote results of the treatment in simple gastric ulcer are determined with difficulty inasmuch as most of the cases analyzed are not divided into simple and complicated. Mayo Robson had followed the patients for from one to five years and was able to find 96 out of 112 who had suffered from gastric ulcer, for whom he had operated, in good health. Unfortunately his cases are not classified as to sequelae. The same may be said of the studies of Greenough and Joslin, of Russell, of Debove, of Murdock and others. It is proper to note that many insist that the remote results of ulcer (with and without complications) treated medically are most unsatisfactory—56 per cent. of the 55 per cent. who were discharged from the Massachusetts General Hospital (G. & J.) were dead or suffered from recurrence after the lapse of five years. Five hundred patients suffering from gastric ulcer were admitted to the London Hospital, 42 per cent. of whom had previous attacks. Bulstrode, who made the analysis, states that 82 per cent. were discharged relieved or cured, but concludes, if the large percentage noted above had recurrences, similar recurrences must have occurred in the 82 per cent. It is Mayo Robson's conviction that 25 per cent. of all cases of ulcer of the stomach treated medically succumb to the disease or its complications. Unfortunately, again we are without the divisions of the simple and the complicated ulcer. Debove and Remond estimate the mortality at 50 per cent.

In this connection the careful analysis of Russell should be given. The results of the treatment of 47 patients (no

division) after a lapse of from two to thirteen years, the direct mortality amounted to 2.1 per cent.; 42.6 per cent. ended in recovery; 4.3 per cent. died from intercurrent disease; 6.4 per cent. cannot be classified; and 44.7 per cent. were suffering from stomach symptoms. Hawkins, in a study of 536 cases, admitted to St. Thomas's Hospital, found the mortality 13.3 per cent., of which 0.9 per cent. died of hemorrhage, 8.5 per cent. of general, and 1.9 per cent. of local peritonitis. Adhesions and pyloric stimosis caused the death of 1.9 per cent. Patterson (Lancet 1906) reports 99 cases cured; 9 result fairly good, and 8 unsatisfactory (4 died and 4 relapse) in 116 gastro-enterostomies, after a lapse of 18 months to 19 years. Again there is no statement of the sequelae, as in the list treated medically, which in 72 cases resulted in 19 cures, 2 probable cures, 5 probably not cured, and 46 not cured. Only 7 of the 19 remained free from symptoms. Von Leube's 556 cases gave a mortality of 2.4 per cent.; of cure, 74.1 per cent.; improved, 21.9 per cent., and unimproved of 1.6 per cent. Huberman reports recurrence in 20 per cent. of 100 cases cured by ordinary medical treatment and of 8 per cent. recurrence when the Lenhartz treatment was employed in 135 cases.

The opinion of most writers is that the medical treatment of simple gastric ulcer, whether the outcome is immediate or remote, is attended by the best results, although our statistics above do not appear to uphold this contention.

THE TREATMENT OF HEMORRHAGE. The subjoined tables are an analysis of the cases which were treated, because life was in peril, specifically for hemorrhage.

Our statistics support the observations of those who admit hemorrhage is best treated medically, but that under many circumstances an operation is justifiable.

TABLE XVI.—INCIDENTS OF HEMORRHAGE CASES. LITERATURE.

Total number of cases			1871
Hemorrhage			160
Sex	Male		48
	Female		93
	Not given		19
Age of occurrence	1–10		0
	10–20		8
	20–30		62
	30–40		38
	40–50		21
	50–60		10
	60–70		4
	Over 70		2
	Not given		15

TABLE XVII.—RESULT OF TREATMENT FOR HEMORRHAGE. CASES COLLECTED FROM LITERATURE.

	Medical.		Surgical.	
	Acute.	Chronic.	Acute.	Chronic.
Cured	37	1	41	14
Improved	6	0	0	0
Unimproved	0	0	0	0
Death	13	3	33	4
Not stated	1	3	3	

For percentages see next table.

TABLE XVIII.—TREATMENT OF HEMORRHAGE. CASES COLLECTED FROM LITERATURE.

Hemorrhage, 160 cases.

		%
Majority of cases between 20–30, women.		
I. 135 acute cases		84.3
77 were treated surgically		57.1
of these cure	41	53.2
death	33	42.8
not given	3	4.0
58 were treated medically		42.9
of these cure	36	62.0
improved	6	10.3
unimproved	0	
death	13	22.4
not given	3	5.3
II. 25 chronic cases		15.7
18 treated surgically		72.0
of these cure	14	77.6
improved	0	
unimproved	0	
death	4	22.4
7 treated medically		28.0
of these cure	1	14.3
improved		
unimproved		
death	2	28.5
Result not given	3	42.8

One case not treated and died.

Treatment of hemorrhage of 160 cases. Surgical.

As regards age and sex, when given.

Acute hemorrhage occurred most frequently between 20–30; 31—26 women, 5 men.

Cure	18	58%	Women	17	94.4%	Men 1 5.6%
Unimproved	13	42	Women	9	69.2	Men 4 30.8

Chronic hemorrhage occurred most frequently between 30–40; 5—2 women, 3 men.

Cure..... 3 60% Women.... 2 66.6% Men.... 1 33.3%
Unimproved. 2 40 all men.

Treatment of hemorrhage of 160 cases. Medical.

Acute hemorrhage occurred most frequently between 20–30; 26—24 women, 2 men.

Cure..... 23 88.4% Women.... 21 80.7% Men.... 2 19.3%
Unimproved. 3 11.6 all women.

Chronic hemorrhage occurred most frequently between 20–30; 2, both women.

Cure..... 1 50% all women.
Unimproved..... 1 50%

TABLE XIX.—HEMORRHAGE.—UNPUBLISHED CASES.

Total number of cases	586	
Cases of hemorrhage	23	3.9%
Age.		
1–10	0	
10–20	1	
20–30	4	
30–40	7	
40–50	6	
50–60	3	
60–70	0	
Over 70	0	
Not stated	2	
Male	11	47.7
Female	12	52.3
I. Acute	20	86.9
Surgical cases	7	35.
of these cure	4	42.8
improved	1	14.3
death	3	42.8
Medical cases	13	65.
of these cure	10	76.9
improved	0	
unimproved	0	
death	3	23.1
II. Chronic	3	13.1
Medical cures	2	
Surgical cures	1	

TABLE XX.—HEMORRHAGE. UNPUBLISHED CASES.

Treatment of hemorrhage as regards age and sex.
Total number of hemorrhages (23) in 586 cases. 3.9%.

SURGICAL...
- Acute hem. most frequent 30–40; 2 males, 2 females.
  - Cure 2 (50%), women (50%), men (50%).
  - Unimp. 2 (50%), women (100%).
- Chronic hem. only one case between 40–50, male—cured.

MEDICAL.... { Acute hem. most frequent 20–30; 3 females.
40–50; 2 females, 1 male.
Cure—all cured.
Chronic, only one case bet. 20–30; female, cured.

The occurrence of hemorrhage in the course of gastric ulcer is placed at figures ranging from 50 per cent. to 80 per cent. of all cases. The figures include those which are small in amount, infrequent or single and those of very frequent occurrence, multiple, and in which large amounts of blood are lost. Treatment is not necessary in many cases. In the other cases medical measures are resorted to. If life is in peril because of frequent small bleedings or because of one or more large hemorrhages, putting life in peril, surgical measures have recently been considered. It is the general concensus of opinion that hemorrhage is usually controlled by well established lines of procedures. Can the few be saved by persistence in medical measures or by resort to surgery? Our statistics uphold the contention that acute large hemorrhage treated by medical means is attended by less mortality than that which is treated by surgical means; the per cent. of death after medical treatment is 22.4 per cent., and after surgical treatment, 42.8 per cent. Of course, the cases have been those in which life was in peril, desperate from the beginning, and perhaps an unfair class for the surgeon. It is presumed the question with each surgeon was one of operation in the face of death. In the unpublished cases, the percentage of hemorrhage, of some types, was small and hence there are only a few to base a calculation. The mortality in the respective divisions is about as given above—medical, 23.1 per cent.; surgical treatment, 42.8 per cent.

The mortality of hemorrhage when medical means are employed is given as follows:

Becker	17.2%
Brinton, Gerhard, Welsh	3.5
Diller	10
v. Leube, Ewald	1.1⅓

The remarkable experience of Moynihan stands out as an encouraging feature. This surgeon saved 19 out of 22 cases. Connell, in a paper published in 1905, finds a lessening of mortality, as follows:—Marion (1897), 66 per cent.; Hartmann (1898), 51.6

per cent.; Bidwell (1899), 50 per cent.; Robson (1900), 53.8 per cent. Rodman's analysis showed a mortality of 40 per cent., and Connell, in an analysis of 100 cases, found a reduction of the mortality in 57 acute cases to 26.3 per cent.

Chronic bleeding ulcer, leading to grave anaemia, is cured by surgical measures, according to our analysis, more frequently than by medical means. The mortality surgically is 22.4 per cent.; medically, 28.5 per cent. In private practice, the cases are too few for analysis. The mortality of Robson's cases (1900) is 10.5 per cent.; of those analyzed by Rodman (1900), 19.3 per cent., and by Connell (1904), 8.5 per cent.

An analysis of the two classes of cases as to age and sex did not, as the tables show, reveal that either of these states predisposed to success or failure in any line of treatment. Greenough and Joslin note a mortality of 17 per cent. in males and 1.2 per cent. in females.

The individual operator stands out. The person of experience tallies higher than the group of operators of small experience. The conclusions seem warranted that the patient is in safer hands by medical treatment, unless he could have the services of a surgeon of large experience. Even then, in acute hemorrhage, unless life is despaired of, the surgeon prefers to postpone operation until the hemorrhage is controlled and the patient relieved of shock and acute anaemia.

TREATMENT OF PERFORATION. The treatment of perforation has been discussed very exhaustively the past ten years. The improved abdominal technique has led to remarkable successes in this field.

TABLE XXI.—INCIDENTS OF PERFORATION. LITERATURE.

Total No. of cases 1,871.

Perforation 536; 28.1%

M	191	Sex
F	334	
Not given	11	

1–10	3	Age
10–20	95	
20–30	217	
30–40	90	
40–50	51	
50–60	29	
60–70	10	
Over 70	5	
Age not stated	36	

Operations for perforation	481
Not operated	55
	536

TABLE XXII.—INTERVAL BETWEEN PERFORATION AND OPERATION.

No. of hours.																		Not given, acute.		Not given, chronic.	
1-12 hrs.		12-24 hrs.		24-36 hrs.		36-48 hrs.		Ov. 48 hrs.		1 wk.		1-2 w.		2-3 w.		3-4 w.		Over 4		58			
*C	D	C	D	C	D	C	D	C	D	C	D	C	D	C	D	C	D	C	D	C	D	C	D
144	38	73	43	21	12	8	17	3	19	12	4	4	0	1	1	..	..	17	4	32	26	1	1
182		116		33		25		22		16		4		2				21		No op.		2	
Acute										Subacute and chronic													

TABLE XXIII.—TREATMENT OF PERFORATION. LITERATURE. 536 CASES.

In 481 operations—89% Cure 65.7% Died 34.3%

In 55 without operation—Cure 11 (20%) Died 30 (54.5%) Not stated 14

Vex. M. 191 (35.6%) F. 334 (62.3%) Not given 11 (2.1%)

The majority of perforations occurred in females between ages of 20–30; 201 cases—142 women, 59 men.

The best percentage of cures was noted when operation was between 1–12 hours after perforation.

In cases of third decade—Cure 135 (67.1%), women 92 (68.1%), men 44 (31.9%)
Unimp. 66 (32.9%) " 51 (77.2%), " 15 (22.9%)

In the same decade the medical treatment was as follows:

14 cases—11 women, 3 men.
Of these—Cure 4 (28.5%), all women.
Unimp. 10 (71.5%); women 7 (70%), men 3 (30%).

TABLE XXIV.—PERFORATION—CASES COLLECTED FROM LITERATURE.

Period of observation after recovery from operation for perforation during which time patients remained well.

1–6 months.....	93
6–12 "	38
1–2 years.....	13
2–3 "	14
3–4 "	3
4–5 "	3
5–10 "	5
Not stated	131

Total number of cases of perforation, 536.

Total number of permanent benefit ranging up to 10 years, 300.

Recurrence.

After 6 months.....	0
After 1 year.....	2
After 2 years.....	1
After 3 years.....	0
After 4 years.....	1
After 5 years.....	0
Not stated.....	1

Benefit but later recurrence, 5

*C, cured; D, died; I, improved; U, unimproved.

TABLE XXV.—RESULT OF TREATMENT OF PERFORATION WITH REFERENCE TO AGE AND SEX. SURGICAL.

Arranged according to decade.

	Cure.		Improved.		Unimproved.		Death.	
	M	F	M	F	M	F	M	F
1–10	0	1	0	0	0	0	0	1
10–20	7	57	0	0	0	0	4	16
20–30	43	91	1	0	0	0	15	51
30–40	22	27	1	0	0	0	21	13
40–50	10	8	0	0	0	0	14	4
50–60	4	3	0	0	0	0	10	4
60–70	1	0	0	1	0	0	3	1
70	0	0	0	0	0	0	1	3
Not given	4	8	0	0	0	0	3	7
No treatment	50	40	..	..	..	..	36	..
(MEDICAL TREATMENT OF PERFORATION.)								
10–20	..	..	..	..	..	..	0	3
20–30	0	4	0	0	3		7	
30–40	1	2	0	0	2		3	
40–50	1	0	0	0	2		5	
Over 50	0	1	0	0	3		2	

TABLE XXVI.—PERFORATION—UNPUBLISHED CASES.

Number of cases		16	2.7%
Sex:			
Male		7	42.7
Female		9	56.3
Age.	10–20	1	
	20–30	4	
	30–40	6	
	40–50	3	
	50–60	1	
Time between perforation and operation not stated.			
Cured		5	31.2%
Died		11	68.8

Perforation spares neither age nor sex, occurring in about the same degree of frequency that ulcer occurs in each sex and in the respective decades. Apparently it is a slightly more frequent accident in males. Contrary to the experience in hemorrhage, age is an influence which counts for or against special lines of treatment, as Table XXIV. indicates. It would be expected that in the extremes of life the mortality would be higher, with or without operation, than in the middle periods. Sex does not appear to have such influence.

The mortality of perforation as given by four observers is about as follows:

MORTALITY OF PERFORATION—OPERATION.

Moynahan	33.3%
Hawkins	43.0
Brunner	48.0
Garre	30.0

MORTALITY OF PERFORATION—NO OPERATION.

Brunner	95.0

Operation was resorted to in 481 of the 536 cases collected by the writer, with a mortality of 34.3 per cent.; cures, 65.7 per cent. Fifty-five cases were not operated on, death taking place in 54.5 per cent. of the cases. Twenty per cent. of the fifty-five were cured and the result not given in the remainder of the percentage. In the unpublished or private cases 31.2 per cent. were cured by operation, and 68.8 per cent. died.

Great interest is attached to the time interval from accident to operation. The analysis shows, in consonance with that of others, that the shorter the interval the higher the percentage of cures. Weir and Foote and afterward Keen (Cartwright lectures) analysed reported cases and Robson and Moynihan and Caird presented individual experience. The figures below give the percentage of death:

	Weir and Foote.	Keene.
Under 12 hrs.	39.13%	19.23%
12 to 24 hrs.	63.63%	50.8 %
24 to 48 hrs.	77.77%	55.55%
Over 48 hrs.	57.51%	25.31%

	Caird.	R. and M.
Under 12 hrs.	5 cases, 40 %	49 cases, 28.5%
12 to 24 hrs.	8 cases, 37.5%	33 cases, 63.6%
24 to 36 hrs.	3 cases, 33.3%	14 cases, 87.5%
36 to 50 hrs.	2 cases, 50 %	2 cases, 100 %

Goldsincker, in a summary of 250 articles, finds a mortality of 50 per cent. and in 236 cases 71 per cent. of the persons operated on recovered. Only 46 of the 236 recovered after the twelfth hour. The author calls attention to the occurrence of multiple perforation.

It follows that skill in early recognition is essential to give the patient as well as the surgeon a chance. The medical attendant who

recognizes the accident and calls the surgeon early is more deserving of honor than the operator, remarks a distinguished German surgeon.

It is important to note that the operation for perforation is followed by more substantial cures than any other procedure, that is, a permanent cure, hence fewer recurrences follow. This is exhibited in Table No. XXIII. French (St. Mary's Hospital) reports 30 cases operated on for perforation, 18 of which were followed many years, and 15 perfectly well. Gosh (St. Bartholomew's) notes 69 perforations—34 died—mortality, 49.2 per cent; 11 operated on and 9 perfectly cured. Patterson's statistics do not fully uphold this view and show the frequency of recurrence after operative procedures in general. Thirty-five patients were operated on for perforation. After 15 months to 2 years 18 were perfectly well (16 ulcer closed and 2 closed and gastro-enterostomy). Recurrence took place as follows:—1 died of second perforation 21 months later; 2 required gastro-enterostomy; 9, symptoms of gastric ulcer arose, and 5 had dyspepsia.

If our statistics are upheld it would seem than an operation which destroys the ulcer, as excision, would be ideal. This is the contention of Rydygier, who advocates resection. He lost two cases after gastro-enterostomy from perforation and two from hemorrhage and suggests these complications are not infrequent. Prof. Dock, in his Yale address, advocates a similar method of operation, and Bell of Minneapolis is also insistent upon this method, while Rodman earnestly urged excision of the ulcer-bearing area.

The Sequelae.

In the treatment of the sequelae or complications of gastric ulcer the surgeon has equal domain with the physician. The following statistics will show how prominent a surgical affection it becomes, and how necessary it is to employ operative procedures. They show that it is not for gastric ulcer most operations are performed, but for the results of ulceration.

That the sequelae of gastric ulcer which cause retention demand surgical treatment our statistics uphold notwithstanding the opposition of weighty authority. This, however, must be said that the presence of, and operation for the relief of, such features does not remove the patient from the category of medical super-

vision. It is as important to continue dietetic, hygienic and medical means as formerly. Indeed, we must be willing to admit, all surgical procedures must be looked upon as those of necessity.

TABLE XXVII.—THE SEQUELAE—LITERATURE.

Retention from				
No. of Sequelae 766 40.0%	Stenosis		504	65.7%
	Adhesions		156	20.3
	Hourglass		81	10.5
	Dilatation		13	1.7
	Pylorospasm		17	0.91
	Cause not stated		5	0.65

TABLE XXVIII.—SEQUELAE—CASES FROM LITERATURE.

Duration of Symptoms of Sequelae.

	Adhesion.	Stenosis.	Dilatation.	Pylorospasm.	Hourglass.
1–6 months	4	24	0	2	1
6–12 "	13	46	0	0	8
1–5 years	44	92	4	2	19
5–10 "	46	127	5	1	22
10–15 "	20	52	2	1	12
15–20 "	14	43	0	1	9
Over 20 "	9	21	1	0	5
Not stated	6	99	1	0	5

This table shows the duration of symptoms prior to operation. The records in which the maximum number of sequelae occurred is given below:

Adhesions.	Greatest number (43) between ages of 30–40 years; more females than males.
Stenosis.	Greatest number (118) between 30–40; more men than women.
Hourglass.	Greatest number (22) between 40–50; more women than men.
Pylorospasm.	Three between 40–50, all females; and two between 50–60, all males.
Dilatation.	Three between 20–30, were women; and three between 40–50 were men.

All admit that ulcer is a disease of early life. The above statistics show, as we would expect, the sequelae are of late life. The duration of the symptoms, 5–10 years, upholds this. If the ulcer was diagnosed early and treated properly, the late sequelae would be avoided.

TABLE XXIX.—SHOWING RESULT OF TREATMENT OF SEQUELAE. CASES FROM LITERATURE.

	Medical.				Surgical.				Recurrence.	Result not given.
	C	I	U	D	C	I	U	D		
Stenosis	0	2	0	4	340	13	8	42	9	18
Adhesions	0	1	0	0	127	4	2	16	5	1
Hourglass	0	0	2	0	61	3	0	12	3	..
Dilatation	2	0	0	0	7	3	0	1	..	..
Pylorospasm	0	0	0	0	6	0	0	1	..	2

TABLE XXX.—DILATATION—13. (1.7%)

Surgical	Cured	7	(53.0%)
	Improved	3	(23.0%)
	Unimproved	0	
	Death	1	(7.7%)
Medical	Cured	2	

PYLOROSPASM—7. (0.91%)

	Cured	6	(85.7%)
	Death	1	(14.3%)

STENOSIS—504. (65.7%)

Surgical	Cured	340	(67.3%)
	Improved	13	(2.5%)
	Unimproved	8	(1.5%)
	Death	42	(8.3%)
	Not given	86	(17.0%)
Medical	Improved	2	
	Death	4	

ADHESIONS—156. (20.3%)

Surgical	Cured	127	(81.4%)
	Improved	4	(2.5%)
	Unimproved	2	(1.2%)
	Death	16	(10.2)
	Not given	1	
	Recurrent	5	(3.2%)
Medical	Improved	1	

HOURGLASS—81. (10.5%)

Surgical	Cured	61	(75.3%)
	Improved	3	(3.7%)
	Unimproved	0	
	Death	12	(14.8%)
	Recurrence	3	(3.7%)
Medical	Unimproved	2	

TABLE XXXI.—PERIOD UNDER OBSERVATION AFTER CURE. PATIENTS REMAINING WELL.

Time.	Stenosis.		Adhesions.		Hourglass.		Dilatation.		Pylorospasm.	
	Surg.	Med.	Surg.	Med.	Surg.	Med.	Surg.	Med.	Surg.	Med.
1-6 mo.	70	2	31	1	12	..	3	1	2	..
6-12 "	59	..	23	..	17	..	3	..	..	..
1-2 yrs.	69	..	15	..	4	..	1	..	2	..
2-3 "	20	..	5	..	4	..	..	..	..	..
3-4 "	13	..	4	..	5	..	..	..	..	..
4-5 "	6	..	1	..	1	..	..	..	..	..
Over 5 "	9	..	1	..	2	..	..	..	..	..
Not stated	106	..	51	..	19	..	3	1	..	..

The sequelae, it is well seen, when they admit of symptoms that are intolerant or perilous, are surgical affections. The nature of the lesion admits of no other conclusion.

The following tables indicate the age and sex of patients treated by surgical means. There is no departure from the usual surgical rules as to prognosis in the respective states. Two cases of adhesions were treated medically, one alleged to be cured and one improved. Three patients with stenosis had a recurrence after surgical intervention. In the instances in which the patients with stenosis, a patient, male, aged 34, was alleged to be cured, one improved, and two died. One woman, aged 70, died. One case of pylorospasm died.

TABLE XXXII.—TREATMENT OF SEQUELAE WITH REFERENCE TO AGE AND SEX. LITERATURE.

Adhesions.

	Cure		Imp.		Unimp.		Death	
Ages	M	F	M	F	M	F	M	F
10–20	2	2	0	0	0	0	0	0
20–30	10	22	1	1	0	0	0	3
30–40	17	19	1	1	0	1	0	4
40–50	13	17	0	0	0	0	3	2
50–60	15	4	0	0	1	0	3	1
60–70	2	1	0	0	0	0	0	0
Over 70	0	0	0	0	0	0	0	0
Not given	2	1	..	..	..	..	..	..

TABLE XXXIII.—TREATMENT OF SEQUELAE AS TO AGE AND SEX. LITERATURE.

Results of treatment of sequelae with table of age and sex at which each is most usual.

	Stenosis.								Hourglass.							
	Cure		Imp.		Unimp.		Death		Cure		Imp.		Unimp.		Death	
	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F
10–20	4	7	1	0	0	0	0	0	0	0	0	0	0	0	0	0
20–30	39	35	0	2	0	0	3	5	2	11	0	0	0	0	1	4
30–40	68	38	4	0	3	1	3	1	5	11	0	0	0	0	1	2
40–50	46	37	2	1	2	1	12	4	6	13	0	1	0	0	2	0
50–60	39	15	1	1	0	0	10	2	3	2	0	0	0	0	0	2
60–70	7	4	0	0	0	0	2	0	1	2	0	0	0	0	..	..
70	1	0	0	0	0	0	0	0	0	6	0	0	0	0	..	0
Not giv.	3	5	1	..	..	1	1	0	..	..	1	1	..	..	..	..

Tables now and then do not agree on many points owing to lack of information presented by the various writers.

TABLE XXXIV.—TREATMENT OF SEQUELAE AS TO AGE AND SEX. LITERATURE.

	Pylorospasm.								Dilatation.							
	Cure		Imp.		Unimp.		Death		Cure		Imp.		Unimp.		Death	
	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F
10–20	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
20–30	0	2	0	0	0	0	0	0	0	1	1	1	0	0	0	0
30–40	0	0	0	0	0	0	0	0	0	2	0	0	1	0	0	0
40–50	1	1	0	0	0	0	1	0	2	1	0	0	0	0	0	0
50–60	2	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
60–70	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
70	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

The sequelae in unpublished cases number 353. The lesions were not clearly defined or were confused in 53 which are not available for analysis. The greatest number were of 1–5 years' duration. All occurred late in life. The summary shows the decade in which the lesions were most frequent.

Adhesions—Largest number (13) between 30–40. More females than males.
Stenosis—Largest number between 30–40. More males than females.
Hourglass—Largest number (4) between 30–40. All females.
Pylorospasm—Largest number (5) between 20–30. Seven males, six females.
Dilatation—Largest number of cases, equally divided between 20–30 and 30–40. Nine males.

TABLE XXXV.—DURATIONS OF SYMPTOMS OF SEQUELAE. UNPUBLISHED CASES.

Time.	Adhesions.	Stenosis.	Dilatation.	Pylorospasm.	Hourglass.
1–6 mo.	5	8	18	8	..
6–12 "	8	31	15	7	..
1–5 yrs.	23	77	34	21	4
5–10 "	10	47	18	3	1
10–15 "	2	8	2	2	1
15–20 "	1	5	2	..	1
Over 20 yrs.	..	4	..	..	..
Not stated	2	2	6	4	1

TABLE XXXVI.—SEQUELAE—UNPUBLISHED CASES.

Greatest number (183) of sequelae occurred between 20–30 years of age.
Next between 30–40, 152; next 40–50, 108.

Stenosis	179	30.5%
I. Surgically treated	171	96.
Of these cured	131	76.6
improved	5	2.9
unimproved	2	1.1
death	18	10.5
not given	23	12.8

II. Medically treated	8	4.
cured	2	
improved	4	
unimproved	2	
death	0	
Hourglass	8	
Surgically treated	8	
Of these cured	6	75.
death	1	12.5
recurrence	1	12.5
Adhesions	57	
I. Surgically treated	54	
Of these cured	40	74.0
improved	2	3.7
unimproved	2	3.7
death	6	11.1
recurrence	4	7.4
II. Medically treated	3	
cured	1	
unimproved	1	
recurrence	1	
Dilatation	108	
I. Surgically treated	31	28.7
Of these cured	20	64.5
improved	2	6.4
unimproved	4	12.8
death	4	12.8
recurrence	1	3.5
II. Medically treated	77	71.3
Of these cured	49	63.6
improved	25	25.4
unimproved	0	
death	0	
not given	3	4.0
Pylorospasm	49	
I. Surgically treated	16	32.6
Of these cured	9	56.2
improved	4	25.0
unimproved	1	6.2
death	1	6.2
recurrence	1	6.2
II. Medically treated	33	67.4
Of these cured	25	75.7
improved	6	16.9
unimproved	1	3.0
death	0	
recurrence	1	3.

TABLE XXXVII.—RESULT OF TREATMENT OF SEQUELAE. UNPUBLISHED CASES.

	Medical.				Surgical.					
	C	I	U	D	C	I	U	D	Recur.	Result not given
Stenosis	2	4	2	0	131	5	2	18	7S 7M	1 Med.
Adhesions	0	1	1	0	40	2	2	6	4S	1 Med.
Hourglass	0	0	0	0	6	0	0	1	1	
Dilatation	49	25	0	0	20	2	4	4	1S	3
Pylorospasm	25	6	1	0	9	4	1	1	1S 1M	

TABLE XXXVIII.—SHOWING PERIOD OF OBSERVATION AFTER TREATMENT OF CASES THAT WERE CURED, DURING WHICH TIME NO RECURRENCE.

	Stenosis.		Adhesions.		Hourglass.		Dilatation.		Pylorospasm.	
	[1]S	M	S	M	S	M	S	M	S	M
1–6 mo.	17	2	7	..	1	..	1	16	2	6
6–12 "	11	..	4	..	..	..	3	8	4	4
1–2 yrs.	12	..	4	..	..	..	2	4	..	4
2–3 "	10	1	5	..	..	..	2	13	1	8
3–4 "	5	1	3	..	..	..	..	2	..	..
4–5 "	5	..	2	..	..	..	..	..	1	3
Over 5 yrs.	3	..	0	..	..	..	1	1	..	4
Time not stated	76	2	17	1	5	..	13	19	5	2

TABLE XXXIX.—TREATMENT OF SEQUELAE AS TO AGE AND SEX, ACCORDING TO DECADES. UNPUBLISHED CASES.

Stenosis. *Surgical.*

	Cured.		Improved.		Unimproved.		Death.	
Age.	M.	F.	M.	F.	M.	F.	M.	F.
10–20	3	3	1	..	..	..	..	..
20–30	10	21	..	..	..	2	2	1
30–40	23	16	1	2	..	1	2	2
40–50	21	14	2	..	..	..	3	1
50–60	12	6	1	1	..	..	3	..
60–70	4	..	..	..	..	..	..	1
Over 70	..	..	..	..	..	..	..	..
Not stated	2	2	..	..	..	..	2	..

Medical.

Cured.	30–40, 2 males, 1 female.	Improved.	30–40, 1 female.
	40–50, 1 male, 3 females.		40–50, 3 males, 1 female.
	50–60, 1 male.	Unimproved.	20–30, 1 male.
			60–70, 1 male.

[1]S refers to surgical and M to medical treatment. Recurrence more frequent in unpublished cases.

Adhesions. *Surgical.*

Age.	Cured. M.	Cured. F.	Improved. M.	Improved. F.	Unimproved. M.	Unimproved. F.	Death. M.	Death. F.
10–20	..	1	..	..	..	..	..	..
20–30	3	4	..	1	..	1	1	..
30–40	4	6	..	..	1	..	2	..
40–50	7	2	..	..	1	..	..	1
50–60	2	1	..	1	..	..	..	..
60–70	..	1	..	..	..	..	..	..
Over 70	..	..	..	..	..	..	..	..
Not stated	1	3	..	..	..	..	..	..

Medical.

Improved. 50, female. males not stated.

Unimproved. 20, 1 female.

Death. 20–30, 1 female.

Hourglass. *Surgical.*

Age.	Cured. M.	Cured. F.	Improved. M.	Improved. F.	Unimproved. M.	Unimproved. F.	Death. M.	Death. F.
10–20	..	..	..	..	..	..	..	..
20–30	..	..	..	..	..	..	..	..
30–40	..	4	..	..	..	..	..	..
40–50	..	2	..	..	..	..	..	..
50–60	..	..	..	..	..	..	..	..
60–70	..	..	..	..	..	..	..	..
Over 70	..	..	..	..	..	..	..	..
Not stated	..	1	..	..	..	..	..	1

Medical.

Cured. 30–40, 1 male.

Pylorospasm. *Surgical.*

Age.	Cured. M.	Cured. F.	Improved. M.	Improved. F.	Unimproved. M.	Unimproved. F.	Death. M.	Death. F.
10–20	1	..	1	..	..	..	..	..
20–30	1	3	..	..	..	1	..	..
30–40	1	1	..	..	..	..	..	..
40–50	1	1	1	..	..	..	..	..
50–60	..	..	..	..	..	..	..	..
60–70	1	..	..	..	..	..	..	..
Over 70	..	..	..	..	..	..	..	..
Not stated	..	..	..	..	..	..	..	..

Medical.

Cured. 10–20, 1 female.
20–30, 2 males, 5 females.
30–40, 3 males, 4 females.
40–50, 3 males, 2 females.
50–60, 3 males, 1 female.
60–70, 1 male.

Improved. 20–30, 1 female.
30–40, 1 female.
40–50, 2 females.

	Dilatation.				*Surgical.*			
	Cured.		Improved.		Unimproved.		Death.	
Age.	M.	F.	M.	F.	M.	F.	M.	F.
10–20	1	..	..	..	..	..	..	..
20–30	3	6	..	1	..	1	..	1
30–40	3	5	..	..	..	1	2	..
40–50	2	..	..	..	1	..	..	..
50–60	..	..	..	..	..	..	..	..
60–70	..	..	..	1	..	..	..	..
Over 70	..	..	..	..	..	..	..	..
Not stated	..	..	..	..	..	..	..	..

Medical.

Cured.	10–20, 1 male, 3 females.	Improved.	20–30, 1 male, 6 females.
	20–30, 8 males, 7 females.		30–40, 1 male, 7 females.
	30–40, 8 females.		40–50, 1 male, 2 females.
	40–50, 4 males, 5 females.		50–60, 1 male, 1 female.
	50–60, 3 males, 1 female.		Over 70, 1 male.
	60–70, 1 male, 1 female.	Died.	20–30, 1 female.

The difference between the cases published and those unpublished is notable in the greater number due to dilatation and to adhesions in the latter. This is due to greater care in giving the cause of stenosis. The surgical treatment of stenosis is attended by a high mortality, but it is presumed the cases were of very grave type and death would have resulted had not interference been permitted. In dilatation the mortality was higher with surgical than with medical treatment. Both forms of treatment were followed by the same percentage of cures. As with the published cases the age and sex were not factors determining the result, apart from their influence in all surgical procedures. It is in this class of cases we must agree with Greenough and Joslin, "which indicates the need of surgical intervention in other than emergency cases of the disease."

Frequency and Mortality of Operations.

The tables which illustrate many features of the various operations (Nos. XL.–XLVI.) present interesting features. The first of the group shows the frequency of gastro-enterostomy and the conclusion therefore of surgeons—that is the operation to meet most of the difficulties. The percentage of mortality in gastro-enterostomy is much higher than that of individual operators. Mayo Robson has had a mortality of less than 5 per cent., and later, in ulcer, of 1.7 per cent.; Moynihan (1906) of 3.5 per cent; Mayo of less than 3 per cent. If a number of operators are

grouped, as by Joslin, the mortality is 23.8 per cent., a not wide departure from our statistics.

The mortality in private or unpublished cases, 9.1 per cent., approaches that of single operators. The mortality of excision is high and yet compares favorably with that of gastro-enterostomy, for recurrence took place in 58 of 964 cases of gastro-enterostomy, or 6.23 per cent., while an excision recurrence took place in 2 of 35 cases, or 5.74 per cent. Two of the nine of Mayo Robson's cases relapsed or recurred and one was not traced.

The percentage of death, when all the cases of all the operators are grouped together, is higher than that of individual operators of large experience. It is well that this is known, for the surgeon who by design operates once or twice only should know the greater mortality. If any blackness can be given to statistics to deter the surgeon who is rushing in to cure dyspepsia, etc., it is also well.

TABLE XL.—NATURE AND FREQUENCY OF OPERATIONS.

Cases Collected from Literature. Total number of operations, 1,193.

Gastro-enterostomy	964	80.8 %
Pylorectomy	24	2.1 %
Excision	51	4.2 %
Pyloroplasty	69	5.2 %
Cauterization	5	0.41%
Dilatation of stricture	4	0.33%
Gastrolysis	37	2.2 %
Suture	38	2.3 %

TABLE XLI.—RESULT OF VARIOUS OPERATIONS. CASES COLLECTED FROM LITERATURE.

	Gast'ent.	Exc.[1]	Pyl'rec.	Gas.	Dil.	Caut.	Pylor.	Sut.
C	690	35	21	22	4	3	48	25
I	47	1	1	4	..	..	4	1
U	25	1	..	6	..	..	2	..
D	144	10	2	2	..	2	6	6
R	58	2	..	3	..	..	9	6

Per cent. of cure of various operations.

Of Various Operations.		Cured or Improved.	Unimproved or Death.
Gastro-enterostomy	964	76.4%	23.6%
Excision	51	70.6	29.4
Pyloroplasty	69	75.3	24.7
Cauterization	55	60.0	40.0
Dilatation of stricture	4	100.	....
Gastrolysis	37	70.2	29.8
Suture	38	68.4	31.6
Pylorectomy	24	91.6	8.4

[1] In two cases of excision final result not given.

TABLE XLII.—LATE RESULTS OF VARIOUS OPERATIONS. LITERATURE.

Permanency of cure in various operations.

	Gastro-enterostomy.				Excision.				Gastrolysis.				Pylorectomy.			
	C	I	U	D	C	I	U	D	C	I	U	D	C	I	U	D
6 mos.	126	9	2	144	10	1	..	10	7	3	6	2	5	1	..	2
6–12 "	103	8	2	..	3	..	..	..	5	..	..	..	3	..	..	..
1–2 yrs.	123	7	4	..	6	..	..	..	3	1	..	..	3	..	..	..
2–3 "	36	3	1	..	2	..	..	..	..	..	..	..	2	..	..	..
3–4 "	26	3	..	..	..	..	..	..	1	..	..	..	..	..	..	..
4–5 "	12	1	..	..	1	..	1	..	1	..	..	..	..	..	..	..
Over 5 "	18	2	..	..	2	..	..	..	..	..	..	..	..	..	..	..
T. not giv.	246	14	16	..	11	..	..	2	5	..	..	..	8	..	..	..
Recurrence	58	..	..	..	2	..	..	..	3	..	..	..	..	..	..	..

	Suture.				Dilatation.				Cauterization.				Pyloroplasty.			
	C	I	U	D	C	I	U	D	C	I	U	D	C	I	U	D
1–6 mos.	13	..	..	6	1	..	..	..	..	..	..	2	17	2	2	6
6–12 "	4	..	..	..	..	..	..	..	..	..	..	..	9	..	..	..
1–2 yrs.	2	..	..	..	..	..	..	..	..	..	..	..	8	..	..	..
2–3 "	..	..	..	..	1	..	..	..	..	..	..	..	2	1	..	..
3–4 "	1	..	..	..	1	..	..	..	..	..	..	..	8	..	..	..
1–5 "	..	1	..	..	..	..	..	..	..	..	..	..	1	1	..	..
Over 5 "	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Time not giv.	5	..	..	..	1	..	..	..	3	..	..	..	5	..	..	..
Recurrence	6	..	..	..	..	..	..	..	..	..	..	..	9	..	..	..

TABLE XLIII.—OPERATIONS. UNPUBLISHED CASES.

Operations for simple ulcer, sequelae, and complications.
Total number of operations, 292.

Gastro-enterostomy	264	90.4%
Excision	7	2.3
Pylorectomy	12	4.1
Cauterization	1	.3
Dilatation of stricture	0	.0
Gastrolysis	5	1.6
Suture	0	.0
Pyloroplasty	3	.1

TABLE XLIV.—RESULT OF VARIOUS OPERATIONS—UNPUBLISHED CASES.

	Gastro-ent.[1]	Excision.	Pylorectomy.	Gastrolysis.	Dilated.	Cauterize.	Pyloroplasty.[2]	Suture.
Cured	208	4	8	3	..	1	2	..
Improved	8	..	..	1	..	..	..	..
Unimproved	6	..	..	1	..	..	..	..
Death	24	2	4	..	..	..	1	..
?	1	..	..	..	..	..	..	..
Recurrence	16	1	..	..	..	..	..	..

[1] In one case of gastro-enterostomy result not given. [2] Gastroplasty, 1 cured. 1 death.

Gastro-enterostomy	C. 75.5%	I. 3.0%	U. 2.2%	D. 9.1%	
Recurrence, and result not given; in remaining cases 10.2 per cent.					
Excision.....	C. 57.1%	I. %	U. %	D. 28.5%	R. 14.2%
Pylorectomy	C. 65.	I.	U.	D. 35.	
Gastrolysis.....	C. 60.	I. 20.	U. 20.	D. 0	
Cauterization.....	C. one case.				
Pyloroplasty	C. 66.6%	I.	U.	D. 33.3	

TABLE XLV.—LATE RESULTS OF VARIOUS OPERATIONS—UNPUBLISHED.

Permanency of Cure in Various Operations.

Gastroplasty, 1 cured, 1 death.

	Gastro-enterostomy.				Excision.				Gastrolysis.				Pyloroplasty.			
Time.	C.	I.	U.	D.	C.	I.	U.	D.	C.	I.	U.	D.	C.	I.	U.	D.
1–6 mos.	25	1	6	24	1	..	..	2	..	1	1	..	1	..	..	1
6–12 "	20	1	..	..	1	..	..	..	..	..	..	..	..	..	..	..
1–2 yrs.	15	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
2–3 "	13	1	..	..	..	..	..	..	1	..	..	..	1	..	..	..
3–4 "	5	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
4–5 "	5	..	..	..	..	..	..	..	1	..	..	..	..	..	..	..
Over 5 y.	3	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Not giv.	108	5	..	..	2	..	..	..	1	..	..	..	..	..	..	..
Rec.	16	..	..	..	1	..	..	..	..	..	..	..	..	..	..	..
Res. n. g.	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..

In the remaining operations the data was not sufficient to make any calculations.

CONCLUSIONS.

Gastric ulcer is a medical disease.

Gastric ulcer with complications and sequelae is sometimes a surgical disease; if perforation occurs, it becomes a surgical affection at once; if hemorrhage occurs acutely, it is rarely a surgical affection; if repeated and chronic, it is.

If the ulcer is productive of perversion of secretory function alone, it remains a medical affection. Inasmuch as hyperchlorhydria is in part a neurosis, the secretory function can be balanced chiefly by medical, dietetic and hygienic measures. Even if pyloric spasm attends the hypersecretion and hyperacidity it does not necessarily take the case beyond medical care. It is wrong to submit such cases to operation, unless motor disturbances become prominent.

If the symptoms and physical signs of retention from obstruction, dilatation, hourglass contraction or adhesions supervene and persist, the case is a surgical one.

If the symptoms of gastric ulcer become continuous in spite of medical treatment and incapacitate or threaten life, if hemorrhage

recurs and secondary anaemia arises, it is a surgical disease. Such cases, however, are always attended by organic sequelae.

The extraordinary frequency of chronic gastric ulcer with sequelae requiring operation is due to neglect of the treatment of an ulcer in its incipiency. Statistics show that most cases are operated on between the thirtieth and fortieth year and have an ulcer history of five or ten years duration.

What, as a medical attendant, should one do with a case of gastric ulcer? From personal experience and a study of recorded cases, I would say, if simple uncomplicated ulcer, employ rest, at first absolute and later modified, a suitable diet and the drugs indicated, for at least four months.

If attended by an organic complication, as pyloric obstruction from thickening or from adhesions, or by dilatation, if extreme, or by hourglass contraction, surgical measures are in order.

If perforation exists there should be no delay in operating.

If hemorrhage exists operation is rarely necessary, and if acute, not unless the peril of hemorrhage outweighs that of operation—a nice estimation of values. If hemorrhage is persistent and gives rise to anaemia operation is indicated. Under any circumstances and until cure is established keep the patient in touch with a surgeon. The physician should never assume the attitude of a distinguished physician who congratulated himself that he did not ask a surgeon to see a case because it had features like those of pancreatitis, a suspicion borne out by the autopsy which showed such lesion. It should be the duty of the physician to associate with himself a surgeon to the end that accidents may be taken care of at once, and organic sequelae relieved.

The final very serious duty is the selection of the surgeon. One who has good technical ability and had considerable experience in gastric surgery should be selected. The operation even of gastro-enterostomy is not trivial and should require the best service at command.

After the surgical procedures of necessity are carried out the case must be treated medically. Medical treatment must be continued over a period of four months at least. Hygienic and dietetic over a period of years.

A patient who has had gastric ulcer should, for all time, observe the hygienic and dietetic rules which keep digestion to an approximate normal state, which prevent anaemia and which, above all, so conserves the nervous system as to prevent neurosis.

GASTRIC ULCER; ON THE INDICATIONS FOR, THE METHODS OF, AND THE RESULTS TO BE EXPECTED IN THE MEDICAL TREATMENT.

BY CHARLES G. STOCKTON, M.D.,

Professor of Medicine in the University of Buffalo, Buffalo, N. Y.

To assemble the evidence that recent experience makes possible in the medical treatment of peptic ulcer and the secondary results of this disease, and to point out what advance had been made, is the first task set us,—a part of the subject that will be dealt with by my distinguished colleague, Prof. Musser.

To decide, in view of all the facts, the most judicious course to pursue, without attempting to press overmuch the importance of any particular method of treatment, is the second task, and to that I devote this paper.

Were we to permit ourselves to take a brief in championing some method with the zeal that success in a comparatively small group of cases sometimes suggests, we should undoubtedly fail in complying with the intention of the makers of this programme.

Above all things it appears important at this juncture not to array against each other the comparative advantages of medical and surgical practices. Rather there should be made the deliberate effort so to view the matter that we may concur in deciding upon our place in the treatment of this disease.

We should exclude from consideration those ulcerative processes dependent upon special infections, like syphilis, tuberculosis and pyemia, except when there can be shown to be a definite relationship between these and peptic ulcer.

We should attempt to exclude, although perhaps unsuccessfully, certain cases that closely resemble in symptomatology peptic ulcer, but in which, despite the occurrence of pain, tenderness, spasm, vomiting and hemorrhage, no ulcer actually exists. It is asserted in some quarters that these cases do in fact suffer from undiscovered ulcer or fissure through which the bleeding occurs. I deny that this is always true. First, because oozing of blood may be seen through the turgid, deeply congested mucosa that shows no lesion even under the magnifying glass. Second, because we know that mere superficial erosions or fissures in an otherwise healthy stomach are rapidly cured by nature and, practically, are without symptoms.

Within these limitations there remain two more or less distinct divisions of peptic ulcer. First: The more frequent type, the acute, at least in the beginning,—which occurs in younger patients and which appears somewhat more often in chlorotic young women; and, second: The type more commonly developing in older patients, especially men past middle life, often beginning as a chronic ulcer and hence possessing a greater tendency to persistence. The difference in the history of these two types strongly suggests that their etiology is not identical, and yet, there is enough sameness in the processes to enforce the belief that in most respects they represent a common disease with the presence merely of a variation.

It should be strongly emphasized, if we are to understand the subject aright, that the stomach possesses an inherent and powerful resistance to accidental injury from ordinary causes. It does not readily succumb to infectious foods nor to wounds from foreign bodies.[1]

I have carefully studied, before and after gastrotomy, the stomach contents of a man who for years swallowed knife-blades, screws, nails and glass. There was evidently irritation, but nevertheless fair digestion of ordinary foods and, on surgical exploration, while there were scars and areas denuded of mucosa, there were no peptic ulcers nor was there history of the same.[2] Beaumont long since proved that the gastric mucosa was repaired with surprising rapidity of injuries deliberately inflicted upon it. There is other evidence that may be adduced to show that the stomach not only resists injury successfully, but that it heals spontaneously in excess of other structures of the body.

From this we must infer that a peptic ulcer includes in its cause and its nature some other factor and quality than a local injury, infection, and an excessively acid gastric juice. We may not exclude these as elements in the cause; they are but steps in a series,

[1] It is interesting to note how the lower animals gorge themselves with putrefied animal tissue, fragments of bone and irritating substances without apparent injury to the gastric mucosa, although in the case of dogs the gastric acidity is extremely high.

[2] This was a case of Dr. Gaylord, who made a gastrotomy and removed 577 foreign bodies of various kinds, besides 144 grammes of broken glass, many fragments of which were embedded in the gastric mucosa. Numerous pieces of mucous membrane were separated from the stomach in the efforts to remove the foreign bodies. The patient made a good recovery and there was little difference in gastric digestion before and after the operation.

of which the chief is some influence that removes from the mucosa its inherent resistance,—something that, when present, enables it to endure a hyperchlorhydria; when absent, leaves the mucous membrane and the other gastric layers an easy prey to the digesting, eroding gastric juice.

That this must be true is evidenced in the instances of serious, even fatal ulcer in patients having gastric juice of low acidity and feeble digestive power and, conversely, by the numerous examples of hyperchlorhydria with exemption from ulcer.

The preventive treatment, the immediate treatment of necessity and the after treatment in surgical cases should take cognizance of this important fact. It is because we have not solved this perplexing, but perfectly obvious, problem that we find the embarrassing recurrences both after medical and surgical treatment. For it must be admitted that the knife has not proved to be the panacea in gastric ulcer that it has in appendicitis; and physicians readily consent to the statement that the medical treatment of chronic cases in old men is often unsatisfactory and in a certain percentage ends in failure.

At least our attitude towards treatment should embrace the acceptance of the reality of a definite lowering of internal cellular resistance in some focus or in foci of the gastric mucosa,—points that are more often located near the pylorus, at the lesser curvature, posteriorly.

Weinland believes that in the cells of the gastric mucosa is developed a substance, an anti-body, that antagonizes the digesting effect of the ferments. This substance may be absent or much decreased in the focus wherein peptic ulcer develops.[1] Why this local deficiency? It has been suggested that it follows a nerve lesion, and some have emphasized that it probably depends upon a tropho-neurosis. As herpes facialis appears in certain individuals with a slight general infection or after mental or bodily fatigue, (and herpes occasionally persists until the general health is restored,) or as painful perforating ulcer of the arm or leg, or as haematoma auris of the insane, may and, apparently, do depend upon a neurotrophic disturbance, so may not the weakness in tissue resistance of the stomach, including the disappearance of anti-bodies, be likewise accounted for? Granted the actual presence of

[1] C. Bolton (Trans. Royal Soc., Sept. 28, 1904) describes a specific gastrotoxic serum, containing an agent that produces necrosis, another that produces hemorrhage in the gastric mucosa.

this local tissue depression, no matter what its nature, we can understand how increased activity, or spasm, coarse and irritating foods, external pressure, etc., come to assist in the evolution of gastric ulcer. Eiselsberg of Vienna advocates and practices the making of a jejunal fistula through which the patient is abundantly fed. Of course this establishes gastric rest, but Eiselsberg[1] believes that the improvement in the general nutrition of the patient also contributes considerably to the cure as well as to the prevention of recurrence.

Our preventive treatment then should be so to guard the patient that the nervous system suffers least strain, that the gastric juice may be moderated in its activity, that the gastric motility (through improper food, stimulants, etc.) be not exaggerated.

The prevention of gastric ulcer might be summarized thus: maintain a calm nervous system in a well-conditioned body. It has been shown that chlorosis is accompanied by gastric hyperacidity; hence anaemia must be overcome. The sharp seeds of fruits, the resisting portions of vegetables rich in cellulose, nuts, salads, condiments, etc., call for unusual, often excessive motor activity of the stomach, and hence should be excluded from the diet.

In acute gastric ulcer the great need is for early diagnosis, for positive conviction, for strict discipline in managing the hygiene, the diet, for relieving the hyperchlorhydria when present as it usually is, and for prolonged treatment. When this control is righteously observed there is, as a rule, little trouble in bringing about immediate relief of symptoms and eventually inducing cure of the disease. The unfortunate cases are those wherein diagnosis is uncertain, or the treatment careless, halting and incomplete. Under such circumstances it is to be expected that a certain percentage will become chronic cases, a small percentage perforative cases. The fault is not in the possibilities of medical treatment, but in its indifferent application. Even in cases in which haematemesis is early and severe this statement holds true.

If in acute hemorrhage the surgeon intervenes and performs a gastro-enterostomy he is not sure of saving the patient. Indeed, experienced surgeons have informed me that they consider this operation unsuited to acute cases with hemorrhage. It would seem to me an unsafe reliance unless the ulcer area be at the same time

[1] Weiner Klin. Woch. 1906, No. 43, p. 1298.

attacked. Such an operation would seem to involve a grave risk; far greater than proper medical treatment for stopping bleeding. Nevertheless, in very rare cases in which medical means prove unsuccessful and where death is imminent, we should consent to give surgery a trial, but it is somewhat unfair to surgery to expect sure relief in this serious state of affairs.

What medical treatment should be adopted in acute cases with bleeding? Procure the most complete rest obtainable of body and mind and keep the stomach out of function. Sometimes most satisfactory results are obtained by carefully, very rapidly, washing out the stomach with ice-water,[1] using a large soft, blunt-pointed stomach tube, or by introducing a weak solution of adrenalin. When the bleeding has ceased, wash out the adrenalin solution and pour in a small amount of gelatine solution, quiet the patient with morphine[2] and atropine or hyoscine; allow him to take frequently bismuth and light magnesium carbonate, suspended in gelatine water, provided there is over-acidity; later introduce per rectum frequent, small quantities (30 to 60 c.c.) of warm, normal saline solution. Such measures usually control even profuse bleeding.

Thereafter there should be rest without food, except the saline enemata, for several days—a week, perhaps. Should we nourish per rectum? Not at first; for the reason that nutrient enemata excite gastric secretion. After two or three days, or immediately, if needed to prevent collapse, small nutrient injections of milk and glucose should be used. As a rule the intelligent use of normal saline solution per rectum, small frequent injections, will accomplish more than nutrient enemata, especially early in the case. When hemorrhage persists or threatens, chloride of calcium in doses of 1.00 to 2.00 gm., diluted as necessary, may be alternated with the sodium chloride solution.

When should we feed the patient? It is better to enforce absolute rest of the stomach for a period of from three to six days. Should alarming weakness appear, aliment should be given. This should be in the form of a thin gruel of arrowroot, farina, etc., perhaps blended with a little lime water and milk, or if it appears to agree better, egg albumin in water or expressed beef juice, at first in small quantities, liquid, unstimulating and always with a close watching of results.

[1] Ewald, Wien. Klin. Woch., 1906, No. 12.

[2] Morphine has the effect of increasing gastric secretion and hence should be combined with atropine.

If the patient endures the starvation well, let him wait five or six days and then begin feeding small portions of milk or gruel, gradually increased. After a few tentative days, if all goes well, larger amounts should be allowed.

Here arises the question as to which is best,—a scant fare, full fare, nitrogenous or non-nitrogenous foods. A study of the effect of the quantity and nature of the food allowable in improving gastric ulcer leads to the conviction that each case must be a law unto itself. One is unwise to insist upon a rule. He should be modest and study his cases carefully. One patient will do best on rather early and rather full feeding as recommended by Lenhartz; another case becomes distinctly worse until complete rest of gastric activity has been carried out for several days, as practiced by Von Leube. It seems to me that these contradictions are to be explained by the element of gastric and pyloric spasm that plays such an important rôle in this disease. Hence the question of excitability, of central and local irritability needs most thoughtful study. Spasm must be prevented and thereby motor insufficiency relieved so that free drainage may be effected. If the results are compatible with feeding, the patient should be fed; if made worse by feeding, he should be starved. I am convinced that in suitable cases, one need not fear allowing rather a full amount of carefully divided and broken up animal food (such as meat juice, ground meat, raw eggs, milk preparations, etc.), beginning with small amounts and gradually increasing the quantity, avoiding the factor of stimulation, and overcoming any symptoms of hyperacidity by administering, p. r. n., a mixture of cerium oxalate (1 part), bismuth sub-carbonate (2 parts), and light magnesium carbonate (4 parts), or lime water, milk of magnesia, and permitting the drinking of warm alkaline water. On the other hand, when there is marked motor excitability with a tendency to pyloric spasm that seems to be increased even by bland liquid foods, complete abstinence must be observed for several days. Meantime the external application of poultices, or of cold fomentations, as advised by Von Leube, are distinctly useful. The good effect of these external applications may be explained in the soothing action which they exercise upon the motor excitability of the stomach. Provided the organ can be kept in a state of relatively passive relaxation, the stomach will empty itself, and drainage will be secured.

This state of gastric calm is occasionally assisted by the giving of fresh olive oil or unsalted butter. Orthoform or anaesthesine

are not only useful in diagnosis, as pointed out by Murdock, but also in the control of pain and indirectly of spasm.

Let us insist and teach that patients with peptic ulcer should submit to early and long continued medical treatment; that they are not cured merely because the symptoms have disappeared, and that they be made to return from month to month, or from week to week, for observation and at times for thorough examination, including the search for occult blood. In this way only, as indicated by Billings, can we be reasonably sure of good results.

From the medical point of view, surgery is called for in ulcer cases to relieve secondary results. That is, to save life when perforation occurs, to secure drainage when stasis of the second degree exists and when it is not relieved by medical treatment; to stop otherwise uncontrollable bleeding, to overcome stenosis or the results of perigastritis, such as disturbances of the motor function from adhesions, and to relieve continued severe pain.

To this extent, the indications for surgery are for relief of results of gastric ulcer rather than of the cure of the disease itself. For the cure of the disease in obstinate cases, the plan followed by Eiselsberg, which has already been referred to, seems reasonable. Except when stenosis exists, gastro-enterostomy alone appears not to be positively curative of peptic ulcer, notwithstanding its usefulness in relieving symptoms. Physicians oppose the operation because it is too unphysiological, because it does not spare the important functions of the pylorus and duodenum, and because patients subsequently suffer from digestive symptoms, the recurrence of the ulcer, and even the starting of new peptic ulcers in the intestine.

To summarize the medical treatment:

Attempt to secure a calm mind, a quiet nervous system and improvement of the general health.

Make a positive diagnosis, begin treatment early, carry it out with painstaking attention to details for a long time.

Obtain general rest. In some cases feed the patient sufficiently, but discreetly; in others starve the patient for a period, depending for support upon frequent, small enemata of normal salt solution.

For the control of hemorrhage, in addition to rest, one may succeed by local treatment through the stomach tube; using ice-water, adrenalin solution, followed by gelatine water.

In irritating hyperacidity one should use local general sedatives and antacids.

To relieve hypertension and spasm of the stomach, in addition to suitable drugs, use external applications according to Von Leube, or the equivalent of these.

Finally, continue treatment long after apparent cure and study the stools of occult blood; but also we should remember the dictum of Bettmann[1] that "It is not alone the question of how long treated, but how well treated." Statistics mean little because of the uncertainty of method and the faulty detail so often observed in the treatment of this disease.

[1] N. Y. Med. Jour., March 9, 1907.

THE CONTRIBUTIONS OF SURGERY TO A BETTER UNDERSTANDING OF GASTRIC AND DUODENAL ULCER.

BY WILLIAM J. MAYO, M.D.,

Surgeon to St. Mary's Hospital, Rochester, Minn.

The contributions of surgery to our knowledge of ulcer of the stomach and duodenum are numerous and of high value, and, taken in conjunction with the recent work in experimental physiology of the digestive system, are throwing much needed light upon this obscure malady. In the past we have depended upon notoriously defective clinical examinations, supplemented by chemical and biological investigations of the gastric contents. These methods, while teaching some truths, often failed to demonstrate the actual condition present. Neither did post mortem revelations give a clear picture of the situation during the curable period on account of secondary complication and terminal infections.

It is the purpose of this paper to examine the subject from the standpoint of the operating room results, with a view of somewhat modifying the generally accepted opinion.

Ulcers of the stomach and duodenum can be divided surgically into two classes. First, the indurated or calloused ulcer, which can be seen and felt during operation on account of the cicatricial tissue which gives the appearance and "feel" of a scar from the outside of the stomach wall. All the positive advances which surgery has made in our knowledge concern this particular group.

The second class has for its type the non-indurated mucous ulcer, which cannot be identified from the outside of the stomach or duodenal wall. The site of the ulcer does not betray its presence by thickening or other sign, and it is usually with much difficulty that it can be located, even if the stomach and duodenum be opened and careful search made of the mucous membrane. We have on several occasions resorted to direct operative inspection when bleeding has been an important symptom, and have not always found it easy to discover the small mucous fissure which was responsible for the trouble.

Nearly all the failures of surgery are to be found in this group of so-called clinical or medical ulcers; because, (a) the ulcer is not

found and many times its existence is problematical; (b) the condition is often confused with pyloric spasm, atomic dilatation, gastroptosis and the gastric neuroses, or other morbid non-surgical conditions; (c) the ulcer does not give rise to mechanical interference with the progress of food, which would introduce an operative indication.

The value of surgical contributions to our understanding of non-indurated ulcer is negative rather than positive in character, and consists in teaching us errors in diagnosis and pointing out lines of future progress.

Location of Indurated Ulcer.

The relative frequency of ulcer has been placed at about ten gastric to one duodenal. In St. Mary's Hospital between July 24, 1905, and March 23, 1907, two hundred cases of ulcer were operated upon. Of this number eighty-seven involved the stomach, ninety-eight the duodenum, and in fifteen there were independent ulcers of each viscus; showing that ulcers which can be actually recognized are fully as often found in the duodenum as in the stomach. How can this apparent discrepancy between the older statistics and these facts be explained? The terminal three-fourths of an inch of the pyloric end of the stomach, the so-called canal of Jonnesco, does not take part in the grinding function of the antrum, and is to be considered with the pyloric apparatus. It is, therefore, less exposed to the acid gastric contents and to mechanical injury.

Ulceration in this canal is uncommon. The large majority of gastric ulcers involve the lesser curvature above the pylorus and extend downwards anteriorly and posteriorly in a manner which we have compared to a *saddle*. Frequently an anterior and posterior ulcer thus exist connected across the lesser curvature by a bridge of cicatricial tissue. The posterior ulcer as a rule is the more extensive.

The typical duodenal ulcer is to be found in the upper inch and a half of the duodenum, and in ninety-six per cent. of the cases extends to or to within three-fourths of an inch of the pyloric sphincter. The deepest part of the ulcer will usually be found just beyond the pylorus, where the acid chyme, which is ejected with considerable force from the stomach, produces an impact upon the intestinal mucous membrane.

The fact that the ulcer extends to and often involves the pyloric sprincter on the duodenal side has led to the erroneous belief that

the ulcer was pyloric, therefore gastric, and the statistics have been compiled on this mistaken identification. In the presence of an ulcer and with the parts more or less fixed by adhesions, it is often a difficult matter to actually determine the location of the pylorus. The best means of identifying it consist in the arrangement of the blood vessels, which is quite striking. A thick-walled vein is to be seen extending from the inferior margin of the pylorus on its gastric side, upwards and across about three-fourths of its extent. From the superior margin a similar vein extends downwards until it nearly or quite meets the one from below.

Relative Frequency of Indurated Ulcer in Male and Female.

It has been accepted as a fact that ulcer of the stomach, including the unidentified ulcer of the duodenum, is more common in woman than in man. Osler quotes the large statistics of Welch and others, showing that sixty per cent. are to be found in women. The Fenwicks, on the contrary, give the proportion as nearly eighty per cent. in men. In Seymour Taylor's collection of one hundred cases, he found seventy-two per cent. in men. In the operating room we found that sixty-two men were operated upon for gastric and duodenal ulcer, to thirty-eight women. On analyzing this percentage, however, it is to be noted that duodenal ulcer is found seventy-seven times in men to twenty-three times in women, while in true gastric ulcer the percentage runs nearly even—fifty-two men to forty-eight women—so that the percentage of male over female is due to the peculiar frequency of the duodenal ulcer in the male, and it is worthy of note that the percentage of gall stone disease is seventy-six per cent. in women to twenty-four in men, the reverse of the statistics just given for duodenal ulcer.

The duodenal ulcer occurs well above the common duct with its alkaline secretions. The curve of the duodenum in men is usually higher than in women, that is, the first portion of the duodenum in men is nearly always ascending, while in women it is often transverse. It seems probable that, for mechanical reasons, the alkaline secretions of the liver and pancreas more readily neutralize the acid chyme in the upper duodenum in women than in men.

Relation of Indurated Ulcer to Cancer.

In fifty-four per cent. of the cases of cancer of the stomach submitted to resection, in sixty-nine cases operated upon in 1905

and 1906, by Dr. Charles H. Mayo and myself, the clinical histories and pathological examination of removed specimens made it certain that the cancer had its origin in ulcer. Fütterer has demonstrated the development of malignant disease in portions of the gastric mucosa which had become separated and buried in scar tissue. The thick mucous membrane of the stomach, with its deep rugae, is particularly subject to chronic irritation. In eighty per cent. of the cases the cancer had its origin in the pyloric end of the stomach where the mucous surface is exposed to trauma, although the antrum has but one-sixth the total area of the gastric mucous membrane. The topography of ulcer and cancer are therefore the same.

We have seen but three cases of primary carcinoma of the duodenum. In one of these it seemed certain that the malignant disease had its origin in ulcer. In the second it was possible, and in the third the extent of the disease did not permit of a sufficiently thorough examination upon which to base an opinion.

Cancer of the duodenum is a rare malady and its etiological relationship to ulcer is apparently not important. Five times, however, we have found cancer of the stomach developing upon the margin of a duodenal ulcer which had extended up to and invaded the pylorus, showing the susceptibility of the stomach to carcinoma as contrasted with the duodenum.

It is possible that the surgical conception of the frequency of gastric cancer developing upon ulcer exceeds the facts, as in a considerable percentage of our gastric resections the operation was begun with the belief that the disease was simple ulcer, and on exploration cancer was found engrafted upon it. The patient who has suffered long from ulcer is more willing perhaps to submit to operation at an early date than are those who have not previously been afflicted with gastric disorder. That cancer frequently develops upon an ulcer base, however, must be admitted.

Non-indurated Mucous Ulcer.

The important advances under consideration, advances which have been brought out through surgical inspection of actual diseased conditions during life, are based entirely on the fact that there is an ulcer present; that this ulcer is indurated; that it is surrounded by scar tissue, etc., in such a fashion as to force its recognition as a prominent pathologic entity. We now come to study a second class, in which the lesion is not demonstrated, and the evidence that it

exists is based upon notoriously defective clinical examinations. The lesion is supposed to be mucous and therefore not to involve those external gastric and duodenal envelopes which would lead to accurate identification. The operation is undertaken upon an unproved hypothesis, and the results of the application of surgery to such indefinite conditions throws still further doubt upon their actual existence.

That an *acute* non-indurated mucous ulcer does exist cannot be questioned. Evidence furnished by direct surgical inspection, by the operative repair of acute perforations, and by operations for acute hemorrhage, demonstrate the fact which has been further attested to by post mortem investigations of deaths from such acute conditions. Does there exist *chronic* non-indurated mucous ulcer, or is the belief in such a condition based upon our knowledge of acute ulcer and the inability to find chronic ulcer clinically diagnosticated? The whole subject is so interwoven with fact and fancy that at the present time it is nearly impossible to secure reliable data with which to lay bare the truth.

In contrasting the two groups, we find that *chronic indurated* ulcer as a rule produces certain phenomena. In the early stages there may be no mechanical symptoms, the distress being occasioned by the food and excessively acid gastric secretions passing over the sensitive ulcerated surface. In the course of time partial healing and development of large amounts of cicatricial tissue about the ulcer base, lead to more or less interference with the progress of food, and if this amounts to retention, the character of the symptoms change and become characteristic of obstruction. Evidences of blood are helpful, but not essential to diagnosis.

Chronic non-indurated mucous ulcer, if it exists, is certainly indefinite in its symptomatology. Pain, gas, distress after eating and moderate stagnation of food with pyloric spasm, constitute the accepted chain of evidence. The nature of the supposed lesion does not lead to the formation of scar tissue, and, as a matter of fact, the symptoms are not only vague, but they are equally characteristic of non-surgical conditions. The actual demonstration of blood, in our opinion, is necessary to even give the evidence standing in court.

Of all misleading symptoms, pyloric spasm is the most mysterious. The term is given to an intermittent pathological contraction of the pylorus and antrum. Some authors seem to consider it a definite

entity having a pathology of its own; the large majority of observers, however, look upon it as a symptom. The interesting and important question is, does it indicate ulcer?

In our experience pyloric spasm is not regularly seen in indurated ulcer, but is an habitual accompaniment of certain other morbid conditions.

The derivatives of the primitive fore-gut consist of the posterior wall of the pharynx, the whole of the esophagus, the stomach and duodenum to a point just below the common duct, the liver and pancreas being offshoots from that part of the fore-gut which is to become the upper duodenum. All of these organs are concerned in the preparation of food for absorption, but do not themselves absorb. Looked at from this standpoint we have the explanation why the first four inches of the duodenum is associated both in its physiology and pathology with the stomach. The duodenum below the common duct, the jejunum, ileum, cecum and the colon to the middle of the transverse if not to splenic flexure, is derived from the mid-gut and is concerned in absorption.

Kölling, Cannon and others have demonstrated beyond a doubt that the control of the pyloric apparatus is largely vested in the duodenum. We have reason to believe that to a certain extent this control can be exercised by all of the just named derivatives of the mid-gut.

We have seen most marked pyloric spasm giving definite signs and symptoms of supposed mucous ulcer, and upon exploration have found gall-stones or appendicitis, or tuberculosis of the cecum. On all of these occasions the real seat of the disease was obscured by the stomach symptoms occasioned by the irregular pyloro-spasm. These experiences have been so numerous that we now look upon pyloric spasm as an indication of an irritation in some part of the interstinal canal which causes an irregular attempt to close the pylorus and thus prevent food from entering the disturbed area. It can be aptly compared to the miner's sluice canal, the sluice gate being controlled by a pulley. Upon necessity for canal repairs the gate is closed, the disturbance appears at the top where the water is prevented from entering the canal.

We have never seen pyloric spasm in connection with diseases of the terminal portions of the bowel which are derived from the hind-gut. How is this control of the pyloric sphincter brought about? The explanation of this may be found in those splendid

experimental studies of the physiology of the digestive tract, which have been given to the world by Starling, Pawloff, Cannon and others. Briefly, it would appear that the maintenance of the body is to a large extent independent of the cerebrospinal system.

The stomach is partially controlled by the central nervous system through the effect on this viscus of sight, taste and smell of food and also by the feeling of repletion which follows the full meal. Intermittent elimination of waste products from the sigmoid and rectum is more or less under conscious control. Through the plexuses of Meisner and Auerbach, acting conjointly with the sympathetic ganglia, the central nervous system has some minor influence on the intervening intestinal tract, but to a large extent the digestive system is still controlled by those primitive chemical messengers which Starling has named "hormones," aided by the sympathetic nervous system.

Hormones are the earliest of all forms of stimulation and are perhaps the most important agents in the control of digestion. An example is the effect of "secrétin" in the stimulation of the pancreatic secretion. Chemical stimulation is undoubtedly the most important factor in the movements of the stomach and intestines, acting as it does directly upon the gastro-intestinal muscle fibre and is the cause of peristalsis.

The curious blending of the sympathetic with the ductless glands is exemplified in the adrenals, thyroids, parathyroids, etc., the products of which have gone under the name of internal secretions. We may here possibly get an explanation of that close association which exists between pyloric spasm, atonic dilatation, prolapse of the stomach and the gastric neuroses which have so often masqueraded as chronic non-indurated mucous ulcer. Be this as it may, the clinical fact remains that for various reasons operation based upon the belief or actual existence of chronic mucous ulcers have, as a class, been unsatisfactory, not that the mortality has been high, but the living through the operation has in a large majority of cases either failed to give relief or has introduced new elements of discomfort.

At the present time we do not consider that a diagnosis of mucous or other undemonstrated ulcer indicates a surgical operation without there exist complications such as perforation, hemorrhage, or obstruction.

A CONSIDERATION OF THE END-RESULTS IN BENIGN LESIONS OF THE STOMACH, SURGICALLY TREATED.

BY JOHN C. MUNRO, M.D.

Lecturer in Surgery, Harvard University, Boston, Mass.

In making this analysis and cross analysis of 150 benign stomach lesions, the patients have been followed from the operating room to the present time in all but a few unimportant instances. Nearly all have come in the service of Dr. Bottomley or myself at the Carney hospital, so that the use of the term end-result is limited to a space covering four years. We believe, nevertheless, that that is ample time to settle the question of success or failure in a preponderating majority of cases. I have tried not to err on the unfavorable side in making my deductions; I have balanced each case as judiciously as possible, allowing for the personal element and for the morale in individual instances, as influenced by long and fruitless medical treatment.

Of the total number of one hundred and fifty cases, eighty-seven showed gross ulcers in the stomach, in the duodenum, or in both. Sixteen cases belong to the class of so-called medical ulcer where no gross, palpable, lesion could be found at operation. Twenty-five more exhibited well marked adhesions without evidence of an active ulcer. Among our earlier cases there were fifteen so-called neuroses, and, finally, we had nine cases classed variously as ptosis, spasm of the pylorus, etc.

There are many types of gross lesion in which we have secured immediate and permanent benefit from the operation. Among these we should include, first of all, congenital pyloric obstruction, and perforated chronic ulcer. The wisdom of surgical intervention in cases of this class is so self-evident that we need not discuss it further. As to the question of immediate gastro-enterostomy in perforation, we believe that if, at the time of primary operation, the condition of the patient permits, an anastomosis is wise because it shortens convalescence and obviates the necessity for a secondary operation. The latter, however, gives good results and should be urged when patients have survived the preliminary operation.

We have obtained good results also in (a) active ulcers near the pylorus but not necessarily occluding it, (b) in ulcers of the

duodenum, with an occasional exception which will be considered later, (c) in the gross chronic ulcers of the lesser curvature and anterior wall, in the pyloric half of the stomach, especially if there is active hemorrhage, (d) in some cases of saddle ulcer, (e) in ulcers of the posterior wall, near the cardia, that infiltrate towards the upper edge of the stomach, (f) in ulcers of the lesser curvature when combined with adhesions that interfere with the gastric motility, (g) in some ulcers of the posterior wall when the pylorus is not mechanically interfered with, (h) in some ulcers at the œsophageal angle of the lesser curvature, (i) in ulcers of the greater curvature, (j) in hourglass stomach, (k) in stricture of the pylorus, (l) in thickening of the pyloric ring without evidence of an active ulcer, and lastly, (m) in dilated, sagging, stomachs secondary to some recent or early process in or near the pylorus, which mechanically interferes with the evacuation of the gastric contents.

In analyzing the partial successes in our gross ulcer cases, one must accept the patient's value of a disturbing symptom with some latitude. An invalid who, for years, has daily watched her digestive apparatus, will give undue prominence to eructation of gas, or to occasional attacks of vomiting while able, nevertheless, to eat heartily, to work hard and to maintain a normal body weight. In several failures in those types which, *a priori,* should have been completely cured, we found either a neurotic strain or some intercurrent disease, such as a severe cardiac asthma. A patient with a double hourglass stomach, or with extensive ulcers and widespread adhesions, would not be completely cured because restoration to a normal motility and to a normal, secreting, mucous membrane would be impossible on the face of it. Such patients, however, complain of symptoms so much less severe than those which obtained before operation, that we feel reasonably satisfied.

We have had definite failures in two duodenal ulcers and in one saddle ulcer, the condition being just as bad as it was before operation. From our experience in similar types, we had expected perfect results. To these failures we must add two cases of sudden bleeding (one being fatal) after complete relief for a year following gastro-enterostomy for duodenal ulcer. We also had a late, fatal, hemorrhage in a case of extensive ulcer embracing both walls of the stomach. Experiences of this sort give us strong reasons for considering Rodman's plea for a more frequent excision, not only on the basis of relieving symptoms, but to prevent malignant degeneration and late hemorrhage.

Among our gross ulcer cases there were four deaths directly attributable to technical failures. These came in the early period of our work. Other deaths were independent of the operation itself but consecutive to it. Patients that came to us after long periods of persistent vomiting were bad surgical risks, not influenced either way by a gastro-enterostomy. This type, among others, we have learned to leave alone. The deaths in congenital obstruction and in perforation of chronic ulcer speak for themselves. In every case delay had been carried far beyond the limit of safety, and operation was advised as a dernier ressort. One patient with chronic anaemia, whose haemaglobin was estimated at 15 per cent., died definitely from anaemia, but, as we had saved an acute anaemia of corresponding degree by anastomosis, we felt justified in running the operative chance. Relapses after temporary relief took place in three cases. We can give no satisfactory explanation. Adhesions that kink the jejunal loop, peptic ulcer or other causes, suggest themselves. That the anastomosis has not closed we feel very confident.

In sixteen cases of so-called medical ulcer we found, as a rule, hemorrhage from the entire mucous membrane or from localized areas, but without any visible lesion. Every stomach, however, was not opened, the diagnosis being made on the clinical evidence of severe, acute, hemorrhages or persistent, chronic, bleeding without palpable or visible lesion encountered at operation. Leukaemia and other general diseases were ruled out so far as lay in our power. We found an open, soft, pylorus in every instance. If there were ptosis or other evidence of a stomach draining itself poorly, we obtained, by operating, a relief that was never more than incomplete. In two cases of medical ulcer we found the calcareous mesenteric glands to which Mayo has called our attention. Two alcoholics with severe hematemesis died promptly after operation from persistent vomiting. One woman with the typical history and symptoms of ulcer had persistent vomiting after a short loop anastomosis. Pylorectomy was then done in desperation, but she continued to vomit steadily to death. Experiences of this kind have taught us to close the abdomen when we are satisfied that there is no gross ulcer, no pyloric obstruction nor other crippling lesion. Without such positive evidence it is best to stop meddling with the stomach. If in the so-called medical ulcer there is functional interference from ptosis, minor adhesions or other cause, it may be wise to make an anastomosis, but the surgeon need not count on the

brilliant result that comes with typical ulcer and stenosis. Can we differentiate a medical case that is bleeding before operation? We believe that it is not always possible so to do. It is not infrequent that patients of this class are referred to us lacking the picture-complex of gross ulcer, and we are accustomed to refer them back to the medical wards for treatment. On the other hand, one of the largest ulcers that we have ever seen gave so typical a picture of the neurotic medical ulcer that we operated only on the principle of "when in doubt, operate."

In twenty-five cases of adhesions without evidence of an active chronic ulcer, we obtained excellent results in all but six and of these two complain only of some eructation of gas. Two patients with persistent vomiting before operation continued to vomit until death two and one half and four weeks later. The adhesions for which we operated were, for the most part, firm bands or masses that extended from the pylorus or duodenum to the gall-bladder region. In many the pylorus was open but the functions of the stomach were evidently so interfered with that some relief to the food current was imperative. In a few we found the stomach dragged down by adhesions of the omentum to the pelvic scars of former operations. We often found merely the induration of an ulcer active at some former period, but at other times the adhesions were too dense and extensive to allow proper examination. Intercurrent gallstones or other surgical lesions were dealt with at the same operation.

The worst subjects for interference were those classed as neurotics. Believing at the beginning of our work that the lack of gastric drainage was the main factor in the production of the protean symptoms in these patients, we undertook to relieve the distress by establishing free drainage. Most of the cases were made worse. In this respect it is interesting to note that quite recently, after exploring a neurotic that had been vomiting for a long time and finding no causative lesion, the symptoms persisted until death two and a half months later. Three neurotic patients derived some benefit; one had a dilated, prolapsed stomach, another had a dilated duodenum and stomach, while the third had typical cardiospasm secondary to an irritable pylorus which was relieved by a Finney pyloroplasty. Some of these neurotics had severe hemorrhages coming periodically both before and after operation when the neurotic storm was at its worst. A gastro-enterostomy would be

followed in the course of a few weeks by regurgitation of bile. If we then made an enteroanastomosis and, perhaps, later closed the pylorus, the result was just as bad. Recently one of our most annoying victims allowed us to restore his gastric apparatus to its original anatomical arrangement with instant relief. Many of the patients had stomachs that were moderately dilated or prolapsed. Others exhibited scars on the serous coat, but in not a single case did we find a gross ulcer or other crippling lesion. Sufferers of this class are still sent to us with remarkable frequency by the internist who has been battling with the condition for years, but it is needless to say that we refuse to interfere.

If, now, we study the results as they bear on the type of operation employed, it is evident that the simpler the technique and the nearer it follows anatomical lines, the better the result. The first method used is that commonly known as the Moynihan, beginning with the long and ending with the short loop. In this method the gastric and jejunal currents pass to the right, that is, in the same direction, the stomach opening being slit-like with its long axis practically in the direction of the food-current. Success with this operation came in patients with gross lesions where the establishment of drainage was a prerequisite factor. Failure naturally came in the medical ulcer and in the neurotic, but there were enough of the adhesion and gross ulcer type that had regurgitant vomiting to make us look for a substitute. Occasionally we were induced to re-operate, making an enteroanastomosis with a fair degree of success. We then tried the posterior gastro-enterostomy with primary enteroanastomosis, with rather better success, but still having an occasional case of regurgitation. Going then to the Roux operation-in-Y, modified by making both anastomoses with the clamp and suture, we were gratified by almost complete success. Unfortunately, however, the technique is somewhat complicated. We tried this method on one of our worst neurotics, feeling that bilious regurgitation would be impossible, especially if the pylorus were closed artificially. Nevertheless we were disappointed to find that almost constant regurgitation ensued. This demonstrated that the mechanics of a gastro-enterostomy may play a very unimportant rôle under certain circumstances but conversely, we believe that almost any form of anastomosis will cure many cases of gross lesion. Following Mayo's lead we then adopted the no-loop operation, first with the longitudinal gastric slit, and later with the opening in the stomach

transverse to the gastric stream. Here the jejunum points to the left, as normally obtains in the majority of cases. With each modification our results improved and we found less and less regurgitation, until now we look for success as regards function if we select the proper cases for gastro-jejunostomy at the outset.

In the meanwhile we had used Finney's method of pyloroplasty in suitable cases, preferring it to Kocher's gastro-duodenostomy as being simpler and more rational. The immediate results were more slow to manifest themselves in the individual case, but the end-results were good. Finney, in a recent report of his own cases, shows that the method is suitable to a wider range of lesions than came within our application. He has obtained good results in active ulcers of the main body of the stomach, etc., and his conclusions are well worth consideration.

Excision of the ulcer-bearing area, which is likewise the cancer area to a great extent, would be the ideal process in all suspicious cases beyond middle life. But it is possible to insure against a fatal operative outcome as in simple gastro-enterostomy? Unfortunately many patients come late, with little power of resistance owing to prolonged starvation, anaemia and loss of courage. We can not feel that our own technique is sufficiently reliable to make us have no hesitation in the choice of operation. Certain ulcers, extensive, brawny and of poor tissue to make repair, should be exercised when by so doing the gastric function will not be impaired. In others we should make a partial gastrectomy, being willing to assume some additional risk if we can fend off a probable malignant degeneration or prevent a late hemorrhage from an ulcer that is not capable of healing. This latter calamity happened in a few of our cases. The decision for the type of operation in such instances is individual, depending upon the surgeon's experience as well as upon the patient's condition.

We must confess that there are certain ulcers which at operation cannot be differentiated from cancer. In patients of this class, reduced by starvation and anaemia, we have lacked the courage to perform a radical operation and have been agreeably surprised to find that lapse of time has settled the diagnosis of a benign lesion when our clinical diagnosis was that of carcinoma. Fortunately the reverse has happened much less often. As a rule the typical cancer is unmistakable, but in our experience of over 100 operations for cancer we have had only about ten in which a radical

excision was possible; a proportion discouragingly smaller than that which has come in the experience of Kocher, Mayo and others.

After reopening a number of abdomens at varying intervals after anastomosis, we have failed to find any indication of closure of the opening when made with the clamp and suture. On the other hand the openings seem to enlarge, and this whether there is a functionating pylorus or not. With the Murphy button we have been less fortunate. Twice have we been obliged to substitute the clamp and suture anastomosis. One of these took place in a gastrectomy for cancer where there was no pyloric opening, and the other in a posterior operation for acute hemorrhage. For this reason we make use of the button only in cases where speed or inaccessibility is an important factor. We have no definite data as to the occurrence of peptic ulcer. Such a lesion may explain the late unheralded hemorrhage in two of our cases of duodenal ulcer. Rarely coming in the posterior operation, as statistics show, we believe the fear of this accident is a small contraindication in cases otherwise suitable for operation.

The simplicity, cleanliness, rapidity and safety of the clamp and suture operation are strong arguments at the present time against any substitutes. Complicated or so-called time-saving instruments are unnecessary. A pair of simple rubber-covered clamps and a needle and thread should suffice in practically all cases. We prefer linen in the serous layer and fine chromic gut in the musculomucous layer. Ether given intelligently and in minimum doses, closure of the omental bursa against hernia and the elevated head position after operation assist in reducing the danger of the operation *per se* to a minimum. It is conservative to maintain that herein we have a very safe therapeutic remedy for most of the benign lesions of the stomach and duodenum.

Further study, broader operative experience combined with associated medical observation, will soon enable the physician as well as the surgeon to accept suitable cases with a large promise for immediate and permanent cure. When relief does come it surpasses that obtained in almost any other type of suffering. It dispels the pain and distress of dyspepsia, the agony of slow starvation and the terror of hemorrhage or perforation. Perhaps more than all, it eliminates, in a larger proportion of cases than is commonly realized, the chance of engrafted malignancy.

Discussion.

Dr. A. Jacobi:—Ulcers of the stomach, both acute and chronic, are frequent at every age. There are those whose experience permits them to say that from 2 to 5 per cent. of the population suffer from it (Ewald). Brinton collected 226 cases, of whom 2 were under 10 years of age; 18, from 10 to 20; 43, from 20 to 30; 38, from 30 to 40; 38, from 40 to 50; 32, from 50 to 60; and 32, from 60 to 70. Similar results are obtained by Cruveilhier and by Rokitansky, who was the first to give an accurate description of the condition.

A late case has been published by Immerwohl (Archiv. f. Kind., vol. 43, p. 321, 1906). The patient was 4 years old, had a chronic ulcer and nephritis, and died of uraemia.

These figures do not cover the case at all. Ulcer of the stomach, and the most dangerous form at that, is not infrequent in the infant. Between the 7th and the 13th year it is not at all rare. Fatal hemorrhage, the so-called melaena of the newly-born, has been seen by most of you. Of Collins' 279 ulcer cases, 7 occurred in the first year; 42, below the tenth. The causes may be various. Prenatal defect in the wall of the stomach accounts for very few only. Thrombosis of the umbilical vein and embolism of small vessels, some of them depending on congenital affections of the heart, explain many. Local injuries by swallowed bones, needles and caustics, now and then hot food, give rise to the most acute forms, with fatal or nearly fatal results. In advanced years it is chronic gastric catarrh that leads to the vast majority of cases. It is these that you mostly see. To the Festschrift, dedicated to me seven years ago, when I was younger, on the completion of my seventieth year, Kinnicut contributed an article in which he spoke of the causation of gastric and duodenal ulcer by burns and by septicaemia, particularly in those instances which are complicated with nephritis, the frequency of which is mostly found at the two termini of life, viz., soon after birth and in old age.

In connection with that statement, it will perhaps interest some of my hearers to be reminded that exactly eleven years ago, in the New York Medical Journal, I directed the attention of the medical public to the large number of cases of nephritis in the newly-born, and that not a few discoverers of the last few years, whose literary knowledge does not antedate the year in which they are writing, have come to the conclusion that the very young infant is forward enough now and then to indulge in nephritis.

The living mucous membrane of the stomach is very liable to swell rapidly and extensively. An acute gastric catarrh raises the membrane in folds which adjoin and compress each other, similarly to what may be observed in the lower part of the rectum, though its varicosities may not amount to what is called hemorrhoids. In these folds small fissures or ulcerations are often found as the results of the mutual pressure of the softened surfaces which are deprived of their epithelium. The stomach and intestines are very amenable to all sorts of detrimental influences. I remind you of the gastric and intestinal ulcerations caused by corrosive sublimate, arsenic, and baryum salts, though they be administered under the skin, and of the influence of the toxins of nephritis just mentioned.

Disorders of the circulation, mainly heart disease—both endocardial and myocardial, also arteriosclerosis, fatty degeneration of the intima, and hyaline degenerations of the arteries—conditions which are found in the vessels of the stomach as well as in the rest of the body—causing indigestion and fermentation quite frequently before actual heart diseases are diagnosticable,—may cause ulcer in advanced life. So do cerebral or peripherous lesions of the nervous system. Van Yzeren (Z. f. Klin. Med., vol. 43) noticed ulcer of the stomach as the result of a section below the diaphragm of the pneumogastric nerve, and explained it by a spasm causing anaemia.

Ophüls (Jour. of Exper. Med., vol. viii., p. 182) made the same observation, but does not charge the origin of ulcer to any trophic influences of the pneumogastric, which are denied, but to the lowering of the motility of the stomach, which is dilated by food pressure. Indeed, many clinicians, like Ad. Schmidt, believe that motor disturbances are at least as important causative forces as disorders of secretion or direct injuries. Defects in the epithelium, amounting to slight wounds, must occur very frequently in the healthy stomach, but the normal mucous membrane covers a slight wound at once, and excludes the gastric acid; only in atonic and anaemic conditions of young women such a rapid recovery would not take place and the recent wound not heal.

Von Yzeren, whom I have mentioned, suggests also the possibility of explaining the gastric ulcer by a trophic influence of the pneumogastric nerve on the gastric mucous membrane, and alludes to the frequency of ulcer in the same family, which may point to abnormal innervation. Similarly, Dalla Vedova (Arch. d. Verdauungs K.

viii) caused gastric ulcer by the irritation and section of the coeliac plexus, which, moreover, contains pneumogastric fibres, and claims it as a trophoneurosis like a mal perforant. This experimental fact explains the fact that there are families in which there appears to be an hereditary tendency to gastric ulcer. This hereditary influence does not appear to be widely known or appreciated, but Rütimeyer has given it prominence in a book published 1906 on "The Geographical Distribution and the Diagnosis of Gastric Ulcer"; so did Armin Huber in a paper on the same subject published in the Münchener Med. Woch. of Jan. 29, 1907.

It would be a grave mistake, however, to exclude all the other etiologic factors. Huber makes that mistake. Indeed the various disturbances of the complicated physiology of an organism have more complicated causes than mere infectious disease, whose main or only cause is a microbe.

All such cases are liable to be very obstinate and to show a predilection for certain areas. It is principally the neighborhood of the cardia, and next to it that of the pylorus, in which an ulcer, single or multiple, is located. It is the latter, the ulcer near the pylorus, that may result in thickening of the surrounding tissue. It may amount to a tumor which is sometimes diagnosticable, mostly on the left side, still it does not amount to a malignant degeneration. I may be permitted to add here that carcinoma will sometimes develop out of and near an ulceration, or from its cicatrix—though the assertion that gastric ulcer will develop into carcinoma in as many as three per cent. of the cases is an exaggeration. From what I shall have to say you will easily concur with me when you consider that such statements are apt to come from those whose horizon is influenced by the fact that they count their cases by the results of their autopsies, both on the living and the dead.

Most ulcers are found on the posterior wall, near or in the small curvature; the next locality of predilection is the neighborhood of the pylorus. Some are found near the cardia and in the fundus, in the anterior wall and the large curvature. When ulcers are in the duodenum and the pylorus, they may merge and cause a gastro-duodenal fistula. Recent ulcers and old cicatrices may be met with together. The size may be no larger than the head of a pin and then detected with difficulty at the autopsy; there are, however, those of the size of the hand. Secondary peritonitis, duodenitis, abscesses in the wall of the stomach, in the liver, and perforations

into the peritoneal cavity, the liver, the spleen, the subphrenic space, and the pleural cavity may occur.

The locality and the size of a cicatrix may give rise to changes in the shape of the stomach. Besides dilatation and muscular hypertrophy, which results from ulcers near the pylorus, terminating in stenosis, the centre of the organ may contract and form a bi-lobular stomach, or hourglass constriction.[1] Or the small curvature may contract so that cardia and pylorus approach one another; or diverticula may occur. (E. Kaufmann, Path. Anat., 3 ed, p. 389.)

Hemorrhage.

Brinton, Gerhardt and Welch believe it occurs in from 3 to 5 per cent. of all cases; Müller, in 10 per cent.; Leube, in less than 1 per cent. This latter statement corresponds with my own observation, which extends over 54 years of private and hospital practice in New York. Blood may be vomited or passed down. Haemoglobin will easily be changed into haematin. That is what changes the color. When there is much acid in the stomach, coagula will be brought up. The acid and the presence of gases in the gut give it the tar color we meet in the stools. Slight hemorrhages may take place for weeks and months, without vomiting. Small quantities of black blood may be found in the feces, sometimes daily. Their presence must be suspected when persons suffering from gastric symptoms become thoroughly anaemic. Still, in such cases great caution should prevail, for menstruation, or swallowed meat particles, or slight extravasation—mostly red, however,—from rectal varicosities may simulate occult gastric bleeding. Besides, there may be extravasations from varicosities of the oesophagus, from slight hemorrhagic erosions, or from disturbances of the portal circulation. And it should be borne in mind that the presence of haemoglobin and red bloodcells by themselves in the masses brought up by vomiting or extravasated from the rectum prove nothing at all. Unobserved bleeding from the gums or the posterior nares of the throat must not be taken for that of a gastric ulcer. Even in what

[1] In this connection the hourglass constriction of the stomach of an ante-natal kind, probably *also* the result of an inflammatory process, may be mentioned. There is a case of J. H. Musser (Phil. Med. Times, xiv., 331, 1883), Dwight (Amer. Jour. Med. Science, vol. 126, 581, 1903), K. Sievers (Berl. M. W. 36, 325, 1899). Possibly, however, such a case means nothing but an atavistic return to the condition of some animals (Ballantyne II, p. 533, Ante-natal pathology).

is called melaena of the newly-born, mistakes may be made. A wise man has written a book lately to explain all the cases of melaena, on the strength of one case of vomiting and expelling blood which could be proven to come from the posterior nares in that same way.

The detection of blood is sometimes very difficult. The tinct. of guaiac and turpentine test teaches the presence of fair quantities of blood only. The arteries from which hemorrhages take place are the coronary—mainly the superior—also the splenic and gastro-intestinal. If it be the coronary, the bleeding may come from both sides. Hemorrhages from a vein, or from an artery *and* a vein at the same time, or from a neighboring vein—for instance, the splenic—are quite rare.

Perforations are grave accidents. Gerhardt, Debove and Remond claim their occurrence in 13; Lebert and Welch, in from 3 to 6; and Leube, in 1.2 per cent. of all their cases. The latter percentage I think to be correct, unless you count the gravest cases only.

Mortality Reports vary widely. Leube has 2.4 per cent. of his 424 patients. There were recoveries after 4-5 weeks in 75 per cent.; improvements, 20 per cent.; failures, 1.5 per cent.; deaths, 2.4 per cent.

Let me ask at once what a recovery in 4 or 5 weeks may mean, and where is the guarantee of the persistence of his results?

Debove and Remond report 50 per cent. Leube's figures rise from 2.4 to 4.1 per cent., in cases of hemorrhage. Koehler has a mortality of 6.4; Warren, of 10; Welch, of 15; Habershon, of 18 per cent. Warren collated 127 cases; 34 per cent. of them attained a complete recovery; there were relapses in 43 per cent.—indeed relapses are reported by all authors, and are experienced by Russell and Joslin, and by all of us. He found carcinomatous degenerations in 3 per cent.; stenosis of the pylorus in 10 per cent.; and death from hemorrhage and perforations in 10 per cent. Schulz had permanent recoveries in 64 per cent., temporary recoveries in 12 per cent., and failures and deaths in 23 per cent.

All these figures, and many more, are collected by Lieblein and Hilgenreiner in the 46th volume of Billroth and Luecke's "Deutsche Chirurgie," which treats in its 600 pages of the ulcerations and the acquired fistulae of the gastro-intestinal tract.

The vast differences, 2.4 per cent. and 50 per cent., prove for the thousandth time that statistics may be the most deceptive and

most irrational method of dealing with any clinical question. The experience of the general practitioner in a large practice amongst the poor or amongst the rich, or amongst men or amongst women; the general physician with a family practice only, or an office practice preëminently; the consultant who is called in to see bad cases only; the stomach specialist; the surgeon in general practice; the hospital physician, in whose wards bad cases only take refuge; the hospital surgeon, who never sees anything but hemorrhages and perforations—what a variety of good observers, but also what a variety of cases and durations, and causes, and observations. Exclusive hospital physicians and surgeons have no experience with the average ulcer of the stomach—theirs is only an experience of bad or of fatal cases. Their statistics refer to hemorrhages and perforations, but not to chronic ulcer of the stomach, which in almost every case is a disease of slow development, chronic in its nature, amenable to dietetic and drug treatment, part of the domain of the general practitioner, and influenced by general therapeutic methods, the last stage of which, in a few cases comparatively, may, or rather will be, an operation. That operation in these few cases should, if possible, be performed by the man who has often done it. I know of a big hospital in which the operation for perforation of the gastro-intestinal tract is frequently performed successfully by the surgeon, unsuccessfully by the adjunct—a significant fact.

The most reliable statistics of chronic ulcer of the stomach could, or should, be established by one hundred or five hundred general practitioners, provided they keep records of their cases. They see them in the beginning, when the symptoms are those of dyspepsia, hyperacidity, and pain only; they see the advanced cases which have been neglected by the factory girl, who is compelled to work 10 to 12 hours to make a living; by the business man, the mechanic, the working man; also the worst class—the so-called acute cases of hemorrhage or perforation. Collected in large numbers, they give reliable statistical data—but in large numbers only.

The main symptoms of gastric ulcer are pain, hyperacidity, and sometimes hemorrhage.

The pain is caused by over-secretion, by undue peristalsis, or by pressure. There are few cases without it. It is almost always local, most intense when the ulcer is in the pyloric region—usually, however, it is found in the median line a little below the ensiform

process. Pressure will always elicit it. It is rarely mild, usually marked. An empty stomach is not, as a rule, sensitive spontaneously—that means without pressure. The pain starts at once during eating, and increases during the activity of digestion, and is diagnosticated from a neurotic pain by (in the latter) the sensitiveness of the empty stomach, which is relieved by eating. Gastric neurosis is relieved by frequent, though small meals.

The pain of gastric ulcer is often transmitted to the back, not opposite to the praecordial region only, but also to the dorsal area and apparently to the lungs, also to the region of the deltoid and the inner aspect of the humerus. When it has healed, it is no longer painful; cicatrices are not sensitive. It should not be forgotten, however, that pain does not always mean ulcer, but that many a pain of seeming gastric ulcer may be called forth by a cold temperature (ice water or atmosphere), or by emotions. Usually, however, it is a meal that provokes it. A pain which rises regularly from 2 to 4 hours after a meal should be referred to the colon, which then is in a condition of chronic inflammation and often dilatation, and exhibits obstinate constipation. Pain arising half an hour after eating is due to duodenal ulceration or to peritonitic adhesions.

Hyperacidity. In its normal condition the gastric secretion has 0.25 (¼) per cent. of hydrochloric acid. It has no injurious influence on the living tissue, which contains in its living blood-vessel circulation a sufficient quantity of alkali. When tissue is broken down, however, that means ulcerates, the vital equilibrium between alkali and acid is disturbed, and the presence of even the normal quantity of gastric acid adds to the lesion.[1] That takes place in the normal conditions of the gastric secretion. But during the presence of an ulcer—mainly when near the pylorus with consecutive functional or organic stenosis, the acid rises to 0.3 or 0.5, or even 0.6 per cent. In uncomplicated gastric ulcer there is no lactic acid. In this respect it differs from carcinoma—which has almost always lactic and usually no hydrochloric acid. This reduction, or absence, is more frequent in cancer than in any other disease. The reduction is noticed in one-third, the absence in two-thirds of the cases, no matter in what part of the stomach the

[1]The same destruction may take place after death, when the circulation is gone, and the acid is still present. In that condition, the so-called gastromalacia—the softening of the stomach—is frequently observed. Until Elsaesser's time, 1848, it was considered a disease of the living. It was he who explained it by the corrosion of the dead tissue by the still present acid.

malignant change may occur. (Benj. Moore, Liverpool, Proc. Royal Soc., 1905, vol. 76; Biochem, Jour. 1906, I., p. 274; W. M. Palmer Biochem. Jour., I., 398.) The blood appears to contain less free hydrogen ions for the gastric cells to secrete in the form of free acid. It has also been observed that in cancer the alkalinity of the inorganic constituents of the plasma is increased. Exceptional cases, however, tell a different story. A few weeks ago, Dr. Willy Meyer exhibited a specimen of pyloric and gastric cancer of large size, taken from a patient whose examination before the operation yielded absolutely no lactic, but large amounts of hydrochloric acid in the gastric secretion. This hyperacidity, however, may be entirely absent—there may be anacidity. The latter condition may accompany cases of dilatation of the stomach which depend on consecutive stricture of the pylorus.

As long as there is the usual form of gastric ulcer, and when no decomposition of the gastric contents takes place, digestion is possible, sometimes even normal. Secretin is formed by the action of hydrochloric acid on the mucous membrane of the duodenum. Even without secretin, in cases of achylia gastrica, the trypsin of the pancreas digests proteids in an alkaline surrounding—like pepsin in an acid. After a while, however, the digestion is, or may become, impaired on account of motory incompetency, or of acetic, butyric, caprylic, and all sorts of fat acids accompanying the hydrochloric. Together they give rise to sour eructations which either begin with eating or follow the meal for an indefinite time, and annoy the patient sometimes all day. Attacks of sour vomiting will be observed during a meal or within one or two hours afterward.[1]

Hyperacidity is not a constant accompaniment of gastric ulcer, but as a rule it must be looked for. In cases of chlorosis it is common; in them the alkalinity of the blood is diminished. Acid exerts its local influence when it meets with an occasional lesion, mostly traumatic, of the gastric mucous membrane—mainly when the latter is in a condition of ill-nutrition or atrophy. I may repeat here that the acid found is not invariably, as Ewald asserted, hydrochloric, but often a fat acid. R. F. Chase (Boston Med. Jour. No. 2, 1907) thinks that such an occurrence indicates a change of treatment. It does not.

[1] Both pain and vomiting repeated and persistent for months may be occasioned by the local pressure exerted by a floating right kidney. This is important to remember for the purposes of a differential diagnosis.

Complicating symptoms have been enumerated:

Glucose. It has no direct connection with gastric ulcer, but with a complication of pancreatic disease.

The leucocytosis of digestion is always absent in carcinoma of the stomach, but it may also be absent in gastric ulcer. Blood examinations are of no account for the differentiation between ulcer and carcinoma.

Spasm of the pylorus is noticed only when the ulceration is in close proximity to it.

Splenitis has been observed by Gerhardt.

The urine is often scanty, of high specific gravity, and may contain diacetic acid and aceton. An ominous symptom is its alkalinity and the absence of sodium chloride, provided that alkalinity be not the result of medication.

The diagnosis may become difficult or complicated by the secondary appearance of chronic or sub-acute peritonitis and adhesions.

What I have said of the influence of the gastric acid on the causation and perpetuation of gastric ulcer, teaches the indication for treatment.

Absolute rest in bed from two to three weeks in acute cases should be a prerequisite. But the large majority of patients are young, ill-fed, sometimes chlorotic—working women, who will apply to you only after they have suffered months or years. Here is your difficulty, as it has been mine in hundreds of cases, and here, quite frequently, the cause of the gravity of the prognosis.

The moderation of heart diseases and the combating of a chronic gastric catarrh act as preventives. The presence of ulcer requires constant alkalinization of the stomach. I say the constant alkalinization, for the administration of an alkali at long intervals is insufficient. I give an alkali before every meal, and at intervals of two hours—not for weeks, but for months, in sufficient quantities. Boas, an authority on many questions relating to the stomach, found that the presence of gastric juice with its 3 p. m. of hydrochloric acid, requires 12 grammes (3iii) of sodium bicarbonate for neutralization. That is why lime water, which contains only 1 part of lime in 780 parts of water, has hardly any claims as a neutralizing alkali. The 200 ccm. of aq. calcis recommended by Norbert Ortner contain 25 centigrammes = 4 grains of calcium.

Which alkali should be preferred? As a rule, those which contain no carbonic acid. Carbonic acid inflates the stomach and does it suddenly—a dangerous result in the imminence or presence of a hemorrhage, and increases peristalsis. That is why sodium bicarbonate, and even calcium carbonate should be avoided. But it is not always possible to do so. The best is calcined magnesia, magnesium oxide. Three to four grammes are easily taken day after day without causing diarrhoea; some may take more daily in (refracted) two-hourly doses. When more alkali is required, the addition of prepared chalk cannot be avoided. Calcium phosphate *may* take its place, but is not an equivalent. Bismuthum subcarbonate—*not* subnitrate, on account of its crystalline gritty condition—may safely and efficiently be added in a daily quantity of from two to ten grammes. One of its accessory effects is the suppression of diarrhoea. Magnesium oxid is chemically analogous to calcium oxid, but is not caustic, because it is almost insoluble in water. As it is readily dissolved in acids, it neutralizes them in poisoning cases better than the carbonates of calcium or of magnesium, the carbon dioxid of which, when rapidly developed, may annoy the stomach or diaphragm, and cause peristalsis. The oxid of magnesium should be given suspended in from 100 to 200 parts of water. If too little water be used, magnesium hydrate may stiffen into a gelatinous hard mass. Even intestinal conglomerates may form, consisting of ammonio-magnesii phosphate.

Diarrhoea should be avoided, and the daily dose of magnesium oxid must be guided by the purgative effect its administration will or may exhibit. The danger of diarrhoea forbids the use of calomel; the Carlsbad water or salts which have been urged as frequent indications should be given with a great deal of mental reservation.

Bismuth is not absorbed by the intact mucous membrane. When this is deprived of its epithelium, bismuth may lead to central convulsions and to local inflammation—like that caused by mercury—of the organs of elimination. Nephritis, stomatitis, and colitis have been observed. Large doses which do not meet a sufficient amount of sulphid of hydrogen may be expelled through the rectum unchanged.

Anaesthesin and orthoform have been recommended in place of other bismuth preparations. They benefit the manufacturers if nobody else.

Excessive peristalsis must be avoided both in mild and bad cases. the equivalent of from 10 to 15 milligrammes of opium to every powder (opium, extract of opium, codein, morphine in proportion) relieves pain and reduces peristalsis. Opium, however, is said by some to increase the secretion of acid. I have not been able to convince myself of that effect. In its place and for its alleged effect of relieving acid, atropin 0.001 has been used subcutaneously once or three times a day. Both the administration and the dose have their inconveniences. Belladonna, the herb or the extract, has been given internally in doses of 0.03 several times daily. There are very few patients, however, who tolerate 0.1 of extract of belladonna for days in succession. As a rule, 4 or 6 centigrammes in successive days is all that can conveniently be given to adults. Children and infants tolerate large quantities in proportion.

Chloral must not be tried as a substitute for an opiate. It is a local irritant. I emphasize that because I have met with the advice to use it.

Very severe pain may require an occasional subcutaneous administration of morphine. In many cases it may be overcome by hot applications, either dry or moist; in many more, by obliging the patient to swallow a big dose of calcined magnesia, with or without bismuth, and lie on his face and belly in order to facilitate the contact of the alkali with the sore and sensitive surface. When the ulcer is near the pylorus, the posture on the right side may be preferred. It is rational to recommend a gradual change from one position to another. With chloroform water given in this condition, I have no acquaintance; it has been recommended in doses of from 150 to 200 cubic centimetres. Six ounces, however, is a rather big dose for that kind of stomach. When a severe pain has been attributed to spasm of the pylorus, some ounces of olive oil have been administered. I prefer the alkaline and narcotic treatment.

To avoid peristalsis, no food must be cold, and the powders must be taken in warm or hot water.

The treatment must be continued a long time—not weeks but months; no matter whether the case presents itself in an acute form or, as usual, in its slow development from an acute or chronic gastric catarrh. The alkaline and cautious dietary treatment will keep the operating specialist comparatively idle, but should follow operative procedures as well. Magnesia will be borne by the mucous mem-

brane better than the normal acid—after operations also. An open ulcer or a mere sore, when exposed to the normal acid of the stomach will get worse and may perforate. Bismuth alone is insufficient.

In hemorrhage or perforation absolute rest must be enforced. Both require morphine subcutaneously. Adrenalin internally was never of any use in my experience. Give it under the skin, it acts better than ergot. In bad cases it is worth while to try the effect of constricting the venous circulation of the lower extremities as you do in pulmonary hemorrhages. Lead has served me badly. 200 ccm. of a five or ten per cent. solution of gelatine have been recommended. One objection to the dose would be its bulk.

Ice bags are indispensable in hemorrhages. Subcutaneous saline infusions may become necessary to relieve collapse, but the amounts of blood are often overestimated, on account of the large quantities of saliva and serum mixed in.

Louis Bourget of Lausanne, in a book published in 1906, is more optimistic in regard to local treatment of gastric hemorrhages than I or others have ever been. I am very anxious to avoid the stomach tube for obvious reasons.[1] Bourget does not *fear,* he advises the introduction of a soft tube. After emptying the stomach he introduces 100 ccm. of a 1 per cent. solution of iron sesquichloride. It is removed and replaced by a new injection. This is repeated four or five times until the liquid returns clear. The same procedure is continued for four or five days. In rare cases he allows the patients to drink the fluid and then turns them on their faces.

Protracted cases—that is those which relapse from time to time,—almost always through the fault of ill-behaving patient—require in addition to the above treatment silver nitrate, 15 milligrammes in a tablespoonful of distilled water three times a day, two hours after a meal. That administration is to be continued a month, discontinued a while for fear of argyria, and perhaps begun again. It may be given in a pill. The quantity I do not exceed in a month is 1.5 grammes. It has been stated that 30 grammes will cause argyria. With the care I have been in the habit of taking, it should not be feared. I have seen two cases of my own, but none these thirty years. Silver nitrate has been credited with neutralizing hydro-

[1]Sometimes because I am afraid of removing the clot which may already cover the bleeding ulcer; mainly when the sore is near the cardia.

chloric acid by throwing down the chlorid. As this is inert, I see no advantage in giving it on account of such an indication; that aim is more readily reached by an alkali.

Iron should not often be given in the anaemia of gastric ulcer. I prefer to look for occult hemorrhage, and to give such food as the ulcerated stomach may aid in changing into blood and tissue. Give no proprietary iron preparations. Chemists and drummers may be gentlemen, but their labels introducing them as "representatives" or "M.D's." may be deceptive. I claim the benefit of the doubt and refuse to admit them. Ferratin, the lactate, and the carbonated iron of the Pharmacopoeia should be selected when iron is to be used after convalescence has been established.

Albuminates of iron are tolerated by many. Ewald prepares a 2-3 per cent. solution of iron sesquichloride; one teaspoonful of this is given three times a day in a wineglass of egg-water. This means 1 white of egg in two parts of water.

Dietetic treatment of ulcer of the stomach, or rather of patients suffering from ulcer:

Leube demands rest for both body and stomach. Patient is in bed, has hot fomentations on his precordia, ice during a hemorrhage. The diet is restricted. For ten days he has boiled milk, bouillon, zwieback; the week following, rice, sago in milk, raw or soft boiled eggs, calf's brain, sweetbreads. Five more days, scraped raw ham, scraped beef, boiled calf's foot, some coffee and tea, mashed potatoes. Seven more days rare roast beef, broiled chicken, macaroni, some little bread. A gradual return to general diet. Leube lives in Würzburg. Lenhartz, who lives in Hamburg, where they eat well and plenty, calls the above diet underfeeding; on the principle that "anaemia and hyperacidity are predisposing causes of ulcer and retard the patient's recovery," the patient has immediately, even after a hemorrhage, a concentrated albuminous diet of milk and raw eggs with sugar, so that after two weeks 3,000 calorics are taken; on the sixth day, chopped meat; on the seventh, rice, on the tenth, raw ham and butter, in addition to the above.

Senator nourishes without over-loading, by gelatine, cream, frozen butterballs, and sugar.

Schmidt, in D. Med. Woch. Nov. 22, 1906, claims that Lenhartz is correct and Leube is correct, but Leube should add eggs, gelatine, butter, cream, sugar, and rice. He also says that chopped meat and scraped ham should be given "only with caution." I prefer caution

both to chopped meat and scraped ham. Neglect caution once and you lose the game, for a time at least.

What I prefer is as follows: No solid food of any kind for weeks. Milk in any shape—raw in the country, if reliable; always boiled in the city and preserved rationally. Buttermilk, sour milk, are well tolerated by most patients. The doses must be small, in frequent intervals; that means five or six meals a day. Milk must not be drunk like water—to prevent hard caking in the stomach; let it be poured into a plate and eaten with a spoon—from two to four quarts in 24 hours. Patients may have stale bread—toasted or not. They should eat it slowly, moistening with saliva only. Normal saliva is alkaline—only slightly acid in dyspepsia and feverish conditions, in diabetes, etc. They may also have rice, powdered, immersed in water for hours, and slowly boiled in water, and finally in milk. Rice water or barley water may be admixed to this milk for people who have to get accustomed to taking milk. Now and then you hear of such as say they cannot and will not take milk. Let them try starvation—they will soon be enlightened and converted. On three quarts of milk and a pound of dry bread they will thrive and gain pounds of weight every month. Somatose, tropon, sanatogen, have been recommended for alleged or obvious reasons. Milk may be peptonized for those who prefer it.

The preparation of milk with hydrochloric acid, which I learned from Dr. J. Rudisch nearly forty years ago, and have often described—that is 1 part of dilute hydrochloric acid in 250 parts of water; which then is slightly boiled with 1 quart of milk (500 parts)— a process which permits milk to coagulate in thin floccules and is easily borne by invalids, is perhaps not so appropriate here on account of its containing or forming sodium chloride in excess. Sodium chloride, which I recommend as a regular addition to cow's milk under ordinary circumstances, should not be used in gastric ulcer. Bourget is wrong when he recommends it. It *will* form HCl.

Whenever anaemia is excessive and hyperacidity (no matter of what nature) is present, egg (mainly the white) is tolerated. Even during bloody vomiting which threatens inanition, tablespoonful doses of iced milk and occasional doses of raw egg albumin, frozen, may be tried.

Nutritive enemata may be required. Ewald beats 2-3 eggs with a tablespoonful of cold water; then a small teaspoonful of starch with

half a cup of a 20 per cent. solution of grape sugar, to which is added a wineglassful of claret. To this he adds slowly the egg mixture, which must not be too hot. Before injecting, he washes the rectum. The enema may amount to 250 ccm.

A year ago I was present when a famous clinical teacher of the West delivered an elaborate address on gastric ulcer as a "surgical disease." I took it that he spoke of the affection as he sees it in his hospital wards only, and of the most acute attacks with hemorrhage or perforation. I feel positive that from what I have said of its frequency in general practice and of the long time it takes negligent or indigent patients to nurse their illness up into the stages of hemorrhages or perforation, you will admit—those of you who are or have been in general practice amongst all classes, mainly the poor or not well to do—that you see it often, treat it often, cure it often, and prevent it from getting into a medical or a surgical hospital ward, there to be used by a diligent and punctilious recorder and the attending staff as material for deceptive statistics.

But you may have relapses and meet with obstinate cases, and those which bleed or perforate. Indeed, we should not claim a recovery when the symptoms have abated after four or five weeks. In that respect even Leube commits mistakes when he reports 424 cases, of which 75 per cent. recovered after four or five weeks; 20 per cent. improved; 1½ per cent. remained unimproved; and 2.4 per cent. terminated in death.

Conservative surgeons are not, however, of the opinion of my clinical friend. They readily admit that 75 per cent. of gastric ulcers are cured by internal treatment. Both Warren (Boston Med. Journal, Nov. 13, vol. 89, 1899) and Krönlein (Arch. f. klin. Chir., vol. 79) agree to that point.

Warren reports on 187 cases. Permanent results could be obtained in 125; complete recovery took place in 34.4 per cent.; relapses in 43.2 per cent.; carcinoma developed in 2.4 per cent.; stenosis of the pylorus and dilatation of the stomach in 10.4 per cent.; death was caused by perforation in 4.8, and by hemorrhage in 4.8 per cent.

Krönlein says that 75 per cent. of gastric ulcers heal under non-operative treatment. The mortality of the other 25 per cent. is from 10 to 13 per cent. He reports on 85 operations, the method being no longer excision as formerly, but gastro-enterostomy. The immediate losses after operation are from 8 to 10 per cent. Final results of 85 operations; recoveries, 61 per cent.; improvements, 24 per cent.; secondary carcinoma, 3 per cent.

Dilatation of the stomach recovers very gradually, the secretion becomes normal, with the exception of a few cases in which HCl was not secreted when it had not been present before the operation. In his opinion no operation should be made early. His indications are stenosis and dilatation, also hemorrhage.

In a very brief paper, published in the N. Y. Med. Monatsschrift, Sept., 1906, A. J. Ochsner claims that the indication for operative interference, for those cases in which no other treatment proved successful, are stenosis, dilatation of the stomach and occasionally hemorrhages. For him the difficulty of obtaining satisfactory statistics is the result of several factors: a patient changes his doctor in the course of a protracted disease; the doctor counts his own good cases, also the failures of the surgeon; the surgeon loses sight of his case, which returns to the practitioner, or to some other surgeon. Altogether Ochsner knows of the occurrence of a large number of cases that never see a surgeon.

The results of the operations depend on the method, to a large extent. Marco Donali (Turin, 1905) published a statistical review of 1,041 gastric operations. The resection of the ulcer furnished 21.4 per cent. of deaths, and so many relapses that the failures amounted to 35.7 per cent. Gastro-enterostomy reduced the percentage of deaths to 14.56 per cent. That is still too many.

The surgeons I mentioned above are no mere operators, and therefore conservative. They are the representatives of a class which we hope will become more numerous—that class which is no longer bent upon splitting medicine into lifeless parts, but consists of physicians who add unusual dexterity to diagnostic powers and therapeutic knowledge. There is one thing they are not doing. These surgeons do not speak of Thiosinamin or fibrolysin which have been recommended for the absorption of all sorts of unabsorbable tissues,—for oesophageal stricture, pyloric cicatrices, and gastro-intestinal adhesions. Thiosinamin 0.2 has been administered subcutaneously in a 10 or 20 per cent. glycerine and water solution every two or three days. The injection causes pain. Its combination with sodium salicylate is called fibrolysin and is not so painful. That is probably the only difference. If they could do all that is claimed for them, there might be a panacea for all sorts of connective tissue hyperplasia in tabes, chronic nephritis, cirrhosis of the liver, chronic peritonitis, and meningitis. Credat Judaeus Apella.

We shall readily agree that stenosis of the pylorus, and gastrectasia, and ulcer not improved by rest and diet and medication should undergo operation; we admit that the indication for operation in hemorrhage or perforation may seem urgent to one and quite doubtful to another,—for it is a fact that many die without an operation, many get well without an operation though its performance seemed urgent, many die after an operation, in spite of it or because of it. It is in such cases that responsibility lies heavy on one's soul, and remorse or reproach, as the case may be, may not die out for a long time. Such are the dangers and the vicissitudes of the war against disease.

Finally, a word of warning. We are not in different camps. The question of internal or of external treatment is no partisan affair. We are all physicians with common aims. To the class of absolutely positive indications for operative interference, we add a number of cases that offer difficulties to the most honest and experienced judgment. In such cases the old proverb should not be forgotten: "anceps remedium melius nullo,"—a doubtful remedy is better than none at all. But after the operator has performed his welcome duty, the case is again yours—the practitioners'. After the operation you may have an organ of doubtful utility. The creation of a funnel is not the restoration of a normal stomach. The patient requires careful supervision of his diet, and may require medication. Hyperacidity may require alkali a long time. Some of our surgeons—I rather feel like saying, too many—are often satisfied with a temporary success. That is why your stomachs may not remain well, why your uteri do not really recover, why your adenoids relapse. These are the cases in which the conscientious skill and the modest patience of the practitioner has to accomplish the final and permanent cure of the patient who has been temporarily relieved by a brilliant achievement—by means of supervising the daily habits and diet, and the local and general circulation, and by hygienic and medicinal preventives. No trumpets tell our glory; that tedious care looks like a humdrum annoyance to the patient, but it saves him from relapses and undertakers.

DR. E. G. JANEWAY, New York:—Dr. Mayo's comprehension of gastric ulcer and its operative treatment and the statements made by some others do not deal with the same thing, as some surgeons insist upon operating on cases that Dr. Mayo says do not belong to the operative class. On the whole, I believe that experienced

surgeons and physicians are pretty well together on this subject. We are all agreed as to operations in cases of perforation. Where perforation exists operation is indicated, and indicated at once. We must not wait, but operate immediately if the best results are wished for. Our medical treatment has no application in cases of perforation except perhaps in rare cases that show a vitality on the part of the individual which would enable him to recover from anything, or where the opening is rapidly sealed by adhesive peritonitis.

The same agreement is also true of the resulting stenotic obstructions of the pylorus and of the duodenum by cicatrices. These in great measure call for surgical relief. The danger of delay was illustrated by the case of a patient who had been advised to have surgical treatment for pyloric stenosis with marked gastrectasia, and visible peristalsis, who succumbed to asphyxia produced by insufflation of his own vomitus. This happened after the lapse of a month from the time of advice, but on the morning of the day he had determined to consult the surgeon.

With reference to lavage in cases of gastric ulcer, do we want to advise it? Since I have had some experience I feel dubious about it. I have met two cases, in consultation with gentlemen who used lavage with resulting perforation. On the other hand one writer (Fleiner) has used lavage in three hundred cases with no bad results, but he was in the habit of referring cases to the surgeon early when indicated, so that his patients were sorted out; of 327 cases he sent 27 to the surgeon, so that the worst cases escaped that danger.

I have the same objection to the subnitrate of bismuth that Dr. Jacobi has. Under the microscope it is in crystalline flakes, with sharp edges, and why it has been so long a favorite remedy in ulcerative diseases of the gastro-intestinal tract, I do not know. It may be found as these dark angular flakes in the passages. I prefer subcarbonate or subgallate, which are in round form.

Some of the nitrite of silver treatment is open to objection, too. It is poured in with the hope of getting some of it on the ulcer, much as if one would pour nitrate of silver on a leg which had an ulcer.

Trousseau called attention to the necessity of paying close attention to the patient's appetite in carrying out treatment, saying that we may not neglect it any more in these cases of gastric ulcer than

in any other disease. His method was to require treatment over a period of two years, using the bismuth subnitrate in large doses, alternating with silver nitrate and calomel and then repeating, increasing the duration of the interval. He recognized the tendency of these cases to relapse and insisted that treatment must extend over a long time before a cure could be assured. Our hospital reports often tell us of patients being cured in three or four weeks to months. We should put the patient on his guard, warning him that his is a chronic disease and that treatment must be continued for a long time.

In one case which came under my observation the patient was supposed to be in great need of operative intervention. Four years ago, after having had repeated attacks of hemorrhage and the other phenomena for ten years, an exploratory laparotomy disclosed a mass as large as a goose's egg on the anterior wall of the stomach. In consequence of this, which was taken to be a carcinoma, the wound was closed, and the patient later sent to her home. Here, with varying health, she so improved last autumn that she felt better and weighed more than at any time in fourteen years—this being three and one-half years after the abandoned operation. Then she imprudently ate on the last of November a large dinner, which was followed by recurrence of gastric distress and later, after two months, by bleeding. I saw her for this, and she is now considering after the lapse of these four years a gastro-enterostomy with the hope of obtaining a more manageable stomach—and to be freed from the fear of the ulcer giving rise to carcinoma. An almost similar case in a man was under my observation. A mass found posterior to the stomach as large as a fist led three surgeons and two physicians to conclude that the stomach had at length become the site of a cancer upon an ulcer. The mass was large, white, firm, and the stomach walls so vascular that it was not deemed wise to remove a piece for diagnosis. When seen again, nine months after the operation, the mass could no more be found. He had, however, varying health, and died from a hemorrhage. This was found due to the erosion of two large vessels which were seated in a large irregularly convoluted mass situated on the posterior wall of the stomach (3 to 6 x 7 inches). This was brought to my notice by Dr. Maury, and a section made by Dr. Horst Oertel, one of my assistants, pathologist to the City Hospital, showed a myomatous tissue with large vessels, in the part examined.

One would suppose that massage would not be used, yet I met a patient years ago who had an adhesion of the stomach wall to the under surface of the liver, where a small mass, the result of an ulcer, could be felt. When physicians had tried lavage, medicines, diet, without avail, a clever masseur produced a cure. I do not advise massage in consequence for gastric ulcer and its sequelae, as a more unfortunate observation may illustrate. A gentleman with duodenal ulcer and partial obstruction had had massage at times for gastrectasia. The ulcer perforated in the office of the masseur, though he claimed that he had not massaged him that day.

Time prevents my speaking further, but after hearing the facts that have been presented to us in this elaborate collection of statistics, and after having the surgical side of the question presented to us in a manner differing from what many of us imagined it would be, I think that we physicians are not so far apart from our surgical friends who have been taught by experience.

THE PRESIDENT'S ADDRESS.

BY REGINALD H. FITZ, M.D., LL.D.

Hersey Professor of the Theory and Practice of Physic in Harvard University.

THE BORDERLAND OF MEDICINE AND SURGERY.

On the front of the building erected for the Harvard Medical School in 1883 are inscribed the names, Hippocrates, Celsus, Galen, Vesalius, Paré, Haller, Harvey, Sydenham, Hunter, Bichat. Of all names in medical history these were deemed the most worthy of such distinction. Each of these men represented an epoch, and the influence of each in his turn has been of undying influence in the progress of medicine from the age of Pericles to the present day.

During this period medicine has become divided and sub-divided into its various specialties, advance has been made now in the one direction, then in the other, but the unity of medicine has ever remained paramount, and whatever has benefited a part has always proved of advantage to the whole. At times this progress has been checked by the frequent quarrels of physicians and surgeons who have shown for each other contempt and hatred, envy and malice, until what should have been a generous rivalry in a common cause became a persistent warfare and an inglorious defeat. But dissensions have lessened, distinctions have become recognized, and a borderline has been traced, shadowy to be sure, but ever changeable and surrounding a territory open to each and productive to all. It is the purpose of this address to call attention to some of the landmarks in this borderland of medicine, to pay tribute to those who have been instrumental in establishing them, and to indicate some of the means by which this region is to continue productive.

The writing of the Hippocratic period, four or five centuries before Christ, recognized but one healing art, medicine, and the physician, for there was no surgeon, was conversant with disease only, which was to be treated in various ways according to its nature. Especial skill was recognized in those who cut for stone, and the physician who took the Hippocratic oath swore to relin-

quish this operation to those who made it a business. Fractures and dislocations, wounds and ulcers, hemorrhoids and fistulae demanded appropriate treatment, but diet, baths, and exercise were depended upon to maintain health, and dietetics played an important part in the treatment of disease.

After the conquest of Egypt by Alexander, its capital, Alexandria, became the medical centre of the world. Rival schools of Greek medicine flourished, the study of anatomy with dissection was pursued, and surgical operations became more numerous. The separation of surgery from medicine thus was promoted, and Egypt became filled with specialists of various sorts. The distinction between medicine and surgery then arose as one of methods of treatment purely, although the physician and surgeon were not so sharply differentiated.

Rome then became the chief city of the world, and Celsus, shortly before the birth of Christ, has recorded the state of medical knowledge and practice at and before his time. His writings, although of great historical and literary value, are considered to be the work rather of a scholar than of a physician or surgeon. Indeed the practice of medicine at this period was regarded as beneath the dignity of a Roman citizen, and was largely in the hands of Greek slaves and freedmen. These practitioners were degraded, immoral, and quarrelsome, often mere sycophants. The writings of Celsus aimed at a higher standard, and he is the first of the systematic writers to distinguish between medicine and surgery. He states[1] that this had already taken place, and the latter had its especial professors. He divided disease into three groups, the first cured by diet, the second by medicine, and the third by manual operations. He assigned to surgery those cases in which the physician makes a wound where he does not find one, and those wounds and ulcers in the treatment of which manual operations are more useful than medicines, and, lastly, whatever ailments relate to bones.

Galen, who lived a century or more after Celsus, also makes it evident that the distinction between medicine and surgery was well established. Trained in anatomy and physiology, he was also learned in general, and was familiar with medical literature from the time of Hippocrates. He studied at various medical centres, and established himself as physician in Rome. At first he taught

[1] L.c. 336.

physiology, lectured upon surgery, and treated surgical cases, although afterwards he referred the latter to specialists, then numerous in Rome. He was sagacious, a distinguished scholar, philosopher and physician. His system of medicine, founded on a scientific and historical basis, served to raise the standard of the physician and to maintain the dignity and prominence of medicine for more than a thousand years. According to Haeser,[2] his philosophical interest led him to harmonize facts and theories, and to establish a system of medicine "which gave an answer to every question and a solution of every problem. His apparent omniscience enchained intelligence and barred all progress for centuries."

For a while the physician became honored and favored, and those especially eminent acquired great riches. With the decadence of the Roman Empire, centuries elapsed before any noteworthy progress in medicine was made. The majority of writers were compilers and commentators, and added but little to the knowledge of their forefathers. Surgery, however, was somewhat more progressive, mainly through the labors of Paul of Aegina, a man of independence and originality, and the most distinguished physician of the Byzantine Empire. Although living in the seventh century he has been regarded as the founder of modern surgery. His writings include the accessible surgical literature preceding his time, and became the surgical standard of Europe.

The Arabs also preserved and maintained the best of Greek medicine during the dark ages following the downfall of the Western Roman Empire, and preceding the formation of the European schools and universities. The Greek teachers, especially the Nestorians, were driven from Athens and Alexandria, and took refuge in Persia, where they established a school. This became the headquarters of the Arabic translations of Greek medical writings after the Arabian conquest of Persia. Almansor, son of Haroun-Al-Raschid, is stated[3] to have instructed his ambassadors to purchase all medical writings attainable and to have caused them to be rendered into Arabic. The doctrines of Hippocrates, Galen, Paul of Aegina, and other Greek and Roman authors thus became incorporated in the writings of Rhazes, Avicenna and Albucasis, and these Arab manuscripts, carried into Europe by way of Spain, became

[2] L.c. i, 350.

[3] Renouard, l.c. 256.

the authority in medicine and surgery till within comparatively recent times.

The monasteries also were important in preserving the influence of Greek and Roman medicine. The Benedictines, in particular, were advised to study Hippocrates and Galen and their library at Monte Casino contained many medical manuscripts. The practice of the monks was limited to their own sex and increased to such an extent that it was prohibited by the Second Lateran Council and at the Council of Tours the disobedient monks were threatened with excommunication. Eventually, however, they were allowed to practise medicine, but were forbidden to make use of surgery. This check to the progress of surgery was promoted also by the Arabs, who often substituted the cautery for the knife, and were more interested in materia medica than in surgical operations. The practitioners of surgery, therefore, were obliged to acquire their knowledge largely through limited opportunities for observation and without especial training. The demand for the surgeon and for the physician also was increasing in consequence of the numerous wars, especially the Crusades, and the pestilences which at times ravaged Europe and the East.

The further development of medicine and surgery was fostered at first in the schools of Salernum and Montpellier, and later by the universities especially in Italy and France. At Salernum a definite distinction was first drawn between the education of the physician and that of the surgeon. At this school in 1240 the medical student was required to pursue a preparatory course of three years in logic, after which five years were to be spent in the study of medicine and surgery. Then, after having passed a prescribed examination, he was permitted to practise, but for a year was obliged to consult habitually with an older physician.[4] The student of surgery, on the contrary, was not allowed to practise until he had spent "at least one year in the study of that part of medical science which gives skill in the practice of surgery." He must also have "diligently and especially studied the anatomy of the human body." At this period anatomy was taught on the pig, and the human body was dissected in the presence of physicians and surgeons but once in five years. In Montpellier at about the same time every practitioner of medicine must be examined, while the surgeon was not required to pass an examination.[5]

[4] Puschmann—Hare, l.c. 207.

[5] Puschmann, l.c. 216.

The schools then gave way to the universities, and Naples, Bologna, Padua and Paris became renowned in their turn as centres of medical education. The Medical Faculty in a given city consisted of all the graduated doctors in medicine of the university, each of whom had the right to teach although but few were appointed for this purpose. In France, in common language, "la Faculté" meant the Faculty of Medicine, which earlier was entitled *Physicorum Facultas* or *Facultas in Physica*. The term *medicus* was applied to the person, and *physica* to the occupation. In Padua in 1268 there were three teachers of medicine. In Bologna in 1371 there were three masters, as they were called, teaching the theory of medicine, three the practice of medicine, and one the subject of surgery. As a rule the number of teachers was small, sometimes but one, as in Heidelberg, in the fifteenth century, and in Italy the professorships of anatomy and surgery were frequently united.

The medical students taking the complete course were few, although the total number of students at some of the universities was large. Bologna in 1260 is stated to have had over 10,000 students, Prague in the fourteenth century 30,000 students, and in Paris in the seventeenth century, the total number of students is said to have been greater than that of the population. It is surmised, however, that these statements include all connected with the university, in addition to the students of previous years.[6]

The lectures consisted in readings from the writings of the authorities, while but few opportunities were given for practical instruction. The students had little or no access to books, since they were in manuscript, often in Arabic, few in number, and very costly. In 1396 the Dean of the Paris Faculty possessed but eleven books, all Arabian, and in 1450 the library of the Faculty consisted of but one book, the *Continens* of Rhazes.

At Montpellier in the fourteenth century, the student in medicine, at the close of his period of study, became a candidate for the degree of master of medical science. At this time medical men were regarded as *medici physici* or *physici* and *medici chirurgi*. The title doctor, originally applied to the teacher, then utilized by the lawyers, subsequently was adopted by the physicians, and was open to all who were legally qualified, since these also were entitled to teach. No examination was necessary for promotion to this degree, but a considerable expense was entailed, which was remitted in case of poor but distinguished students.

[6] Sybil's Hist. Ztschr., 1881, xlv, 291.

Thus the doctors of medicine were but few in number. In Paris between 1391 and 1431 there was a yearly average of thirty-six. In 1500 there were seventy-two. In 1596 there were 350,000 inhabitants, and two years later there were but ninety-six doctors, according to a list prepared by the Dean of the Faculty of Medicine. In the seventeenth century, with 540,000 inhabitants, there were from one hundred to one hundred and ten doctors in the Faculty of Medicine,[7] and in 1768 there were only one hundred and forty-eight. During these years there were many practitioners of medicine and surgery, for instance, 2,000 in Milan in 1288, with a population of 200,000.[8] Some of them were licensed to practise, but without the title of doctor, others practised surgery with and without a license, and there were many empirics of all kinds.

The distinction between the physician and surgeon thus became established as one of the nature and extent of the education. The physician, who might also practise surgery, received a university education extending over a long period of time, and might obtain the dignified title of doctor, which made him a member of the Medical Faculty, with a right to teach and to take part in its proceedings. He was an educated gentleman and a man of authority.

The surgeon, on the contrary, who had not received the education of the doctor, might acquire a sufficient theoretical knowledge of surgery in a year at the end of which he could obtain the degree of master of surgery. Even then all practical knowledge for both classes of graduates must be obtained outside the university from those actually dealing with the sick. Many of these surgeons were without means to pay for university training, had little or none of the knowledge of Latin or Greek necessary for the doctor, and often began their career as barbers. The latter became associated with medicine at an early day, according to Gairdner,[9] because it was necessary that monks should be shaved and bled periodically (five times a year at the monastery of St. Victoire in Paris) and it was convenient to employ the same person for the two occupations. Furthermore, monks were not allowed to draw blood, although venesection was a highly commended remedy for various ills, and the monastery barber became a convenient proxy. The act of bleeding was not without a certain

[7] Raynaud, l.c.

[8] Russell, l.c. 144.

[9] Edinb. Med. J., 1864, ix, 684.

risk to the operator, for the Visigoths in the sixth century decreed that if a freeman should be injured by venesection a fine should be paid. If he should die, the relatives might do what they pleased with the venesector. If a slave should be harmed or killed he should be replaced by another slave.[10] Since the barbers practised venesection it was considered a disgrace for the doctors to bleed and Longoburgo, a surgeon of Bologna, in 1252, blamed them for holding this opinion. The barbers extended their practice from venesection to the application of leeches, the use of the cautery and, eventually, to minor surgery.

Included among the practitioners of surgery were attendants at bathing establishments, some of whom had acquired the habit of blood-letting, also natural bone-setters and experts for operations for hernia and stone, perhaps deriving their skill through inheritance of family secrets from generation to generation. To these were added the public executioners, who were called upon to reduce dislocated joints and to treat the sprains, bruises and bleedings resulting from the various means employed in the torture of the condemned.

The educated surgeons, of whom some were also doctors of medicine, desired to be protected from identification with the larger class of irregular practitioners and wished for an honored position like that of the physician. In Paris in the thirteenth century they formed an association for this purpose, and after a few years established a college subordinate to the Faculty of Medicine with statutes corresponding to those of the university, giving them the privilege of holding stated meetings, and of educating and examining students. This college of St. Côme, apparently through the influence of Jean Pitard, médecin-chirurgien, and the surgeon in Palestine of Saint Louis, became well established. Its early success was enhanced, and its students increased in number by the presence, in 1295, of Lanfranc of Milan, who had left Italy on account of the civil wars then prevailing. He wrote a work on surgery and gave the students practical instruction in clinical and operative surgery. The influence of the college became further increased through the decree of Philip the Fair in 1311, that "no male or female shall practise surgery in Paris who has not been examined by our sworn surgeons of Paris, named and called together for that purpose by Jean Pitard, our sworn surgeon of the Châtelet or his successors."[11] Thus the barbers were made to submit to an examination in surgery.

[10] Fort., l.c. 467.

[1] Billings. Dennis' System of Surgery, 1895, i, 42.

At this time physicians, even when laymen, were almost exclusively enforced celibates, it being considered that sanctity aided largely in producing favorable results from the use of drugs, and unmarried professors in medicine filled the higher positions in the University of Paris. The members of the Medical Faculty of this city were jealous of the rising importance of the surgeons. They regarded the art of the latter as a handicraft exercised also by many illiterate persons, and they wished to maintain the control of medical affairs. They, therefore, undertook to divorce the practice of surgery from medicine, and in 1350 their statutes demanded that baccalaureates in medicine should swear not to perform surgical operations or to treat wounds, ulcers, fractures, dislocations and tumors. This attempt at the separation of surgery from medicine did not meet with universal approval, for in the same century, Guy de Chauliac, educated at Paris, Bologne and Montpellier, and the most learned surgeon of his day, complained of this tendency and entitled the first edition of his chief work *Inventorium sive Collectorium artis Chirurgicalis Medicinae.*

The barbers in their turn rebelled against the aggressiveness of the surgeons, and in 1372 obtained from Charles V a decree permitting them to apply plasters, ointments and other medicaments for bruises, abscesses and all open sores. It would seem that the barbers took advantage of this opportunity, for in 1425 they were forbidden to operate and were restricted to the dressing of ulcers and the treatment of corns.

The restriction of celibacy was now removed from the members of the Faculty of Medicine, and the competition of the surgeons was more keenly felt. The Faculty in 1505 took the barbers under its protection on condition that they would not use internal remedies without consulting with one of its members. To spite the surgeons it gave the barbers a course in surgery, and later one in anatomy in French. The surgeons rebelled and the court decided that a member of the Faculty should give the lecture, the surgeon dissect, and the barber assist. The Faculty also examined the barber-pupils, conferred upon them the degree of master, and assigned to them the name of barber-surgeon. The surgeons then appealed to the university for independence and secured a decree separating them from the barbers, demanding of the surgeons a knowledge of Latin and of logic, and allowing them to confer the degrees of master, bachelor, licentiate, and doctor of surgery. These privileges were retained

with a single intermission for more than a century. The barbers were compelled to treat only the mildest cases, and to summon a surgeon in all the severe affections. The Faculty, on the other hand, renewed its contract with the barbers, who agreed not to practise except with those licensed by the Faculty, and not to give laxatives, alteratives, or "comfortatives" in Paris or its suburbs, and to prescribe nothing except what could be done by manual operations.

The surgeons then united with the barbers, who practised medicine to a certain extent, despite their agreement, and in 1655 actively opposed the Faculty, but met with a crushing defeat by an act of Parliament in 1660. It was decreed that the barbers and surgeons should submit to the Faculty, that the surgeon-barbers should not assume the dignity of bachelor, licentiate or doctor, only that of candidate, master and member. This union of surgeons and barbers in a subordinate position persisted until the establishment of the Royal Academy of Surgery by Louis XV in 1724.

Meryon[12] informs us that in England a similar state of affairs existed, and that the practice of medicine was largely in the hands of monks until the time of Henry VIII. The best educated had received their medical instruction in Italy and in France, but were few in number. The country was flooded with ignorant pretenders of all kinds, who became much more numerous after the dissolution of the monasteries. Surgery was practised by barbers and surgeons, most of whom had acquired their knowledge, as in France, by observation, without especial training. They were united into a brotherhood or company which became incorporated in 1540. The control of the practice of medicine and surgery was vested in the ecclesiastic authorities until 1518, when it was transferred to the Royal College of Physicians, then chartered by the efforts of Linacre. In its attempt at restricting the practice of medicine, it met with active or tacit opposition from surgeons, barbers and apothecaries, most of whom were uneducated and all subject to its control. Occasionally, a Fellow of the College of Physicians was also a "brother of the Worshipful Company of Barbour Chirurgians." In the time of Elizabeth the surgeons were prohibited by law from giving internal remedies for sciatica and even in the case of wounds. The surgeons, in turn, succeeded in preventing the barbers from practising any branch of surgery except the pulling of teeth, and in the reign of Charles I, the trade

[12] L.c. 1, 435.

of barber was transferred to barbers not members of the Company, but subject to its authority.

In Scotland, also, the union of barbers and surgeons existed[18] and in the early part of the sixteenth century the city of Edinburgh incorporated the guild of barber-surgeons, previously established for an unknown period as a brotherhood. The surgeons and barbers were granted a monopoly of their trade, the right to dissect annually one executed criminal, and to make and sell all "aquavite" within the burgh. In return they bound themselves to take no apprentice who could not read and write, and to examine and prove "every friedman among them." Towards the close of the century the members of the guild, unable to pass a satisfactory examination, were restricted to the trade of barber and maker of aquavitae. Thus arose a distinction between the barber and the surgeon, and the former, although still a member of the guild of barber-surgeons, became associated with the apothecaries. Some fifty years later it became necessary for the guild to restrict the apothecaries from the practice of surgery. This was then defined as "operatiouns and applicatiouns . . . . upon the living and dead bodies of men women and children and the curing of diseases . . . . as tumours woundis ulcers luxatiouns fractures . . . . by operatiouns applications dyett medicaments and what els requisite to the compleit cure."

The barber-surgeons later became surgeon-apothecaries by taking up the sale of drugs, and united with the apothecaries in opposing the request of the physicians for a charter which infringed upon some of the rights claimed by the surgeons. This union was short-lived, and the apothecaries complained of not being allowed to bleed, apply plasters, or remove ascitic fluid after death. In 1681 the physicians succeeded in overcoming their opponents, and the Edinburgh Royal College of Physicians received its charter. The surgeons obtained a patent, creating them a college in 1695. It was stated that the field of surgery includes the cure of all sorts of wounds, fractures, dislocations, tumors, ulcers and like accidents. All internal disease belongs to medicine, but the surgeon is to treat all disease from external causes.

During the greater part of this period of quarrel and strife, especially in France, between physicians and surgeons, but little advance was made in the progress of medicine. The field of

[18] Practitioner, Lond., 1905, lxxv, 103.

surgery, however, became greatly widened through the genius of Ambroise Paré, who found his opportunity in military surgery then transformed through the introduction of gunpowder into warfare. New problems arose, to be solved only by an independent, forceful thinker. Beginning as a barber's pupil, he became the counsellor of kings. By his originality and breadth of view he gave distinction to surgery, second only to that conferred two centuries later by John Hunter. His writings were in French, therefore accessible to all classes of surgeons, including the barbers, whom he did not forget in the height of his success. In consequence of his achievements he was admitted to full membership of the College of St. Côme, although he was unable to comply with an existing requirement, a knowledge of Latin.

The domain of medicine and surgery now became alike widened by the renewal of interest in the study of anatomy. From the days of the Alexandrian school to the beginning of the fourteenth century, a period of more than 1,500 years, all anatomical investigations had been made on the lower animals, and little or no attention had been paid to human anatomy. It was thought disrespectful to the dead to dissect the human body, although the most horrible tortures were inflicted on the living, often in consequence of simple differences of opinion. Occasional autopsies were held in cases of suspecting poisoning, and in Italy, in the thirteenth century, also to gain information concerning the nature of fatal disease. Reference already has been made to the institution of a public dissection of the human body at Salernum once in five years during this period. In the following century Mondini of Bologna dissected the bodies of two women, although he did not dare to examine the brain for fear of committing a mortal sin. At this time yearly dissections were made in Venice, and in Montpellier. Such public dissections often were spectacular, and dignitaries of the city and distinguished citizens were invited to be present. The bodies were chiefly those of executed criminals, though occasionally derived from other sources. The dissections represented almost wholly a demonstration of the two great cavities of the body, and were completed in three lectures. But little anatomy was learned from such exercises, and practically no addition was made to the existing knowledge of the subject until the sixteenth century. Then Vesalius, physician and surgeon, but above all, anatomist, by his investigations demonstrated the falsity of the doctrines of Galen,

based on the dissection of the lower animals. He was given abundant material for his researches, and by the elimination of error and the discovery of truth, placed the study of medicine upon a scientific basis. Through him and his contemporaries, Fallopius, Eustachius, Fabricius, soon followed by Spigelius, anatomy became a science, dogmatic medicine acquired a control, and surgical operations were made more exact. The researches of these anatomists became widely and rapidly disseminated through Gutenberg's recent invention of printing. Typography also multiplied the works of Celsus, Galen and Avicenna, which were reproduced in Latin, while the surgical publications had the advantage of being printed in German, French and Spanish.

The numerous and important discoveries in human anatomy which first showed the inaccuracy of Galen's teachings were soon followed by a still more important and fruitful discovery, that of the circulation of the blood, by Harvey. Theoretical statements of vital processes thus were subject to control by the actual knowledge of existing conditions. Research into the structure and functions of the body now became a subject for independent study, and medicine began to depart from theory and to assume more of the shape of an experimental science. The physician who had been pompous, dogmatic, full of false and absurd ideas, content to discuss and argue, and to refer the treatment of the patient to the barber and the apothecary, became in consequence of this scientific movement a patient investigator of facts, and a serious, often impatient critic of theories.

The example was set by Sydenham, the English Hippocrates, and a founder of exact observation of the patient. He despised tradition and observed the phenomena of disease as a process in nature, not differing essentially from the manifestations of health. He overthrew the authority of Galen in practical medicine as Vesalius had in anatomy, and Harvey in physiology. Sydenham, however, as a pioneer in the scientific consideration of disease, devoted his attention exclusively to the observation and analysis of symptoms, and lacked the essential control furnished by the study of the associated and resulting lesions. Original, independent, and an accurate observer, he makes no mention of Harvey, apparently was unaware that Malpighi had already discovered the capillaries which he maintained could not exist, and had an outspoken contempt for pathological anatomy.

The time now had arrived for the development of this branch of the medical sciences, progress in which was to be intimately connected with all further advance in the theory and practice of medicine and surgery. The isolated and accidental discoveries in this subject made by the earlier anatomists in the progress of their dissections, and by others interested in post-mortem examinations, were collected by Bonetus. The association of symptoms and lesions, however, was the work of Morgagni, who first duly emphasized the importance of pathological anatomy in the control of clinical observation. His labors, by supplementing those of Sydenham, were the beginning of modern methods of observation and thought in medicine, as contrasted with those of Galen and his followers.

In the meantime, the utilization of the recent discoveries in anatomy, physiology, and in the clinical characteristics of disease was being accomplished at Leyden. There is no mention of any clinical teaching worthy the name, for more than fifteen hundred years, until an attempt was made at Padua, in 1578. This was soon followed by the introduction of bedside teaching at Leyden by Otto de Heurn, the professor of practical medicine, and his successor, Sylvius Le Bö, followed the same plan. Boerhaave, who succeeded Le Bö, systematized this form of teaching and made Leyden the centre of medical education, and the resort of students from all parts of the world. The clinic consisted of but twelve beds, but he had the privilege of drawing patients from elsewhere. His students were taught the value of anatomy and physiology in medical practice, and he pursued the method of Sydenham in his observation and analysis of symptoms. One of his pupils, Haller, a skilled anatomist, eminent as a physiologist, became professor of medicine and surgery, although he is said never to have performed a surgical operation. He is called the father of experimental physiology, and by his method of investigating vital functions established a scientific basis for the study of disease.

During this period of activity in medicine, learned men of scientific mind and training were studying the phenomena of health and disease as physicians, not as surgeons. The latter remained practitioners devoted to an art which seemed far removed from scientific interest, and which presented but little attraction for educated men. A change was about to take place, however, and was initiated by the definite separation of the barbers from the

surgeons. Equivalent rights were granted to the Royal Colleges of Physicians and of Surgeons in London and in Edinburgh. The Royal Academy of Surgery in Paris received the right to grant the degree of Master to those already possessing the degree of Master of Philosophy. The Paris surgeons thus were made independent of the Faculty of Medicine, and soon established a school of surgery with practical teaching, and with the requirement of three years of study.

Surgery became a science, however, through the labors of one man, John Hunter, anatomist, physiologist, pathologist and surgeon. He showed that the methods employed in the accurate study of disease were the common property of surgeons and physicians. It was his aim to demonstrate that the relation between processes and results in health to be determined by physiological experimentation must exist in disease, and be determined by like methods. He was the founder of experimental pathology alike applicable to medicine and to surgery. In the words of Paget[14] "until his light shone, the border line between medicine and surgery was sharply defined. On the one side were physicians, not only learned in their own calling, but men of high culture, educated gentlemen, and the associates of gentlemen. On the other side were those whose profession was a handicraft, whose education was mainly practical, and whose associates were unknown. After his time the relation between surgery and the sciences was established, and the scientific surgeon gained entrance into the most cultivated class."

The effect of Hunter's work was enhanced by that of Bichat, equally distinguished for breadth of mind, intensity of application, and with a genius for generalization. Physician at the Hotel Dieu, anatomist, physiologist, and pathologist, his life was spent in searching for the seat of disease by observation and experiment. Dying at the age of thirty-one, his services to experimental physiology and pathology in determining the actual seat of vital processes in health and disease, have placed his name among the immortals. What Hunter did for surgery Bichat accomplished for all medicine, and the study of disease from his time became the study of processes taking place within the tissues.

During the first half of the nineteenth century, the scientific study of disease, whether more medical or more surgical in its therapeutic relations, progressed to the advantage of each. This was largely by the adoption of uniform measures, but especially by virtue of the

[14] Brit. M. J., 1877, i, p. 191.

increasing knowledge of pathological anatomy and pathological histology. The rehabilitation by Corvisart of the significance of percussion, first applied to the more thorough recognition of internal derangements by Auenbrugger in 1767, was the foundation of physical diagnosis. Läennec added auscultation. The use of these methods made it possible to recognize modifications of structure regardless of symptoms, and by the association of the evidence thus obtained with the latter, and with that furnished by post-mortem examinations, dogmatic and inexact medicine was transformed into a rational and intelligible department of knowledge. These pioneers, followed by Louis, Andral and numerous lesser lights, were the leaders in the school which produced Bright, Hodgkin, Addison and Graves, of the British physicians.

The work of Morgagni and Bichat was carried on by Cruveilhier and Rokitansky, essentially descriptive pathological anatomists. As the century advanced, the improvements in the construction of the microscope and the progress made in chemistry greatly increased the evidence to be obtained in the study of the lesions of organs. The opportunity thus was afforded for the recognition of a pathological histology and of a cellular pathology as fundamental conceptions of disease. Scientific medicine and scientific surgery became definitely established, and the routine practitioners of medicine and of surgery began to appreciate the value of the broader training. The centre of scientific thought in medicine was now transferred to Germany, and became lustrous chiefly through the teachings of Virchow, pupil of Johannes Müller and of Schönlein. These teachings applied to all medicine, and the keenness of his insight, the accuracy of his observation, the breadth of his view, the soundness of his judgment, and his knowledge of the past, afforded a combination of qualities without peer in medical history. Every specialist in medicine felt the influence of his teaching. His assistants and pupils were important discoverers, and their work often was inspired by his suggestions and fortified by his criticisms. His achievements in anthropology, in philosophy, in citizenship, and in affairs of state gave evidence of his genius. John Hunter and Bichat alone of all medical worthies stand nearest him, and Virchow had the advantage of Hunter's example and accomplishment and the results of Bichat's genius to aid in his development. During the same period surgery was represented by skilled anatomists, ingenious and brilliant operators, judicious

counsellors, and admirable teachers, especially in France and England. Despite the example set by Hunter, surgery continued to remain more of an art than a science, but approached as near perfection as the conditions of the day permitted. The leaders believed in a surgical pathology, and Paget set the example of its study, which was subsequently followed with even greater success by Billroth.

The latter half of the nineteenth century is filled with records of medical progress, all of which lie within reach of living memories. The discoveries in medicine of this period have added more to the welfare of mankind, as manifested by relief from suffering and disease, than the sum of all known efforts in this direction since the origin of man. Common to medicine and surgery, they have been alike beneficial to each, they have resulted in a redistribution of the borderland of medicine and surgery, giving and taking, adding more and more to the domain of surgery, relinquishing less, but opening fresh fields to the labors of the physicians. Anaesthesia and asepsis lead all the rest, and the names of Morton, Pasteur, and Lister, stand high among the world's benefactors. The discovery of surgical anaesthesia was an inspiration, that of antisepsis the result of gradual, prolonged, often discouraging labors of many men. The work of all led to the success of the few, and the genius of Pasteur revealed for surgery what the talent of Lister made available.

The early effect of these discoveries was to make a radical change in the treatment of certain diseases. Operations hitherto avoided in consequence of their length, and the sufferings of the patient were gradually assumed. The former distinction between medical and surgical therapeutics, based upon the use of medicinal or of manual methods, upon diseases of the surface or of those of the cavities of the body, rapidly gave way. The duration of life with an operable disease not treated surgically, was contrasted with the possibility of rapid and permanent relief by measures which offered more or less immediate risk to life. Anaesthesia thus encouraged the operator no longer disturbed by the immediate sufferings of the patient, and increased the number of surgeons as well as that of the operations. In his Presidential Address before the American Surgical Association, J. Collins Warren[15] gives the total number of operations at the Massachusetts General Hospital during the five years before anaesthesia as 184, while in the five years after

[15] Trans. Am. Surg. Assoc., 1897, xv, 1.

anaesthesia it was 487. This increase in the frequency of operations was attended, as a rule, with an increase in their mortality. The latter was due, in part, to a wider selection of cases, which included patients previously regarded as unsuitable, and in part to the prolongation of the operation, with its attendant risks, especially of infection, since speed in operating was no longer of especial importance.

The borderland diseases which first felt the effect of the new discovery were those of the abdomen. This cavity had been invaded by the surgeons from time to time in the early history of medicine but, as a rule, only on account of the gravest conditions immediately threatening life. Paul, Bishop of Merida, in the sixth century, is stated to have removed a dead infant through an abdominal incision, and a number of laparotomies in extrauterine pregnancy, some successful, had subsequently been performed. Caesarean section upon the dead mother had been undertaken before the days of Hippocrates. It was not until the fourteenth century that it was performed upon the living, and then upon a woman condemned to death on the charge of having stolen consecrated wafers to sell to the Jews.[16] In 1610 it is stated to have been performed upon a patient by Trautmann,[17] but with a fatal result. The possibility of saving child or mother, perhaps both, led to the relatively frequent repetition of this operation. Michaelis collected reports of 250 operations before 1750, and from that year to 1839 there were 328 additional cases.[18] Nevertheless, the mortality was so high, estimated by Greig Smith[19] at 75 to 80 per cent., and without a success for many years in certain hospitals in Paris, Berlin and Vienna, that this operation was condemned by many writers.

In 1549, Zaccarello, a bath-man in Naples, is stated[20] to have successfully removed an enlarged spleen, and in after years the excision of the normal spleen extruded through an abdominal wound was repeatedly accomplished with success. It thus became evident that this organ was not absolutely essential to life, although it was not removed with intent until 1826, and but two splenectomies had been performed from 1711 to 1846. In 1602, Florian Matthias, a bath-man in Prague, successfully removed a knife through an abdominal

[16] Puschmann, l.c. 275.
[17] Eulenburg's Real. Encyclopaed., 1897, xii, 58.
[18] Chelius, System of Surgery, Trans. by South, 1847, ii, 436.
[19] Abdominal Surgery, 5th ed., 1896, ii, 395.
[20] Adelmann, Arch. f. klin. Chir., 1887 xxxvi, 442.

incision, and, according to Richardson,[21] nine authentic and successful cases of the removal of foreign bodies from the stomach had been reported up to 1848. Gall-stones are said[22] to have been taken from the gall-bladder in 1618 with some doubts as to the life or death of the patient at the time, and several removals subsequently were effected more as a matter of chance than of design.

The one operation above all others which led to the transfer of many affections of the abdominal organs from the care of the physician to that of the surgeon, is to be credited to American surgery. Dr. M'Dowell of Danville, Kentucky, in 1809, first performed ovariotomy, with the intent of relieving his patient from cystic disease of the ovary.[23] Before his time a possible ovarian cyst had been removed unexpectedly and with a fatal result by Morand in 1718, who punctured the tumor with a trocar and on withdrawal of the instrument the wall of the cyst followed. The normal ovary also had occasionally been removed when it was found as a portion of the contents of a hernial sac, or for no special reason when it lay at the bottom of a pelvic abscess. The customary treatment for ovarian disease hitherto had been either medicinal, by drugs, or mechanical by pressure, puncture, the injection of irritating substances into the tumor, or incision with or without drainage. The disease was absolutely incurable despite the favorable reports occasionally to be met with, which, from our present point of view, must be attributed mainly to errors in diagnosis. According to Graily Hewitt,[24] "The probable duration of a case of ovarian disease of progressive character is, in 85 to 90 per cent. of the cases, two, or at the most, three years; of the apparently 'stationary' or chronic cases, the prognosis is more favourable, but in such cases the disease is liable at any moment to start into fresh activity."

M'Dowell's patient thought herself pregnant, but his diagnosis was a large ovarium. "She was affected with pains similar to labour pains, from which she could find no relief. Having never seen so large a substance extracted, nor heard of any attempt or success attending any operation, such as this required, I gave to the unhappy woman information of her dangerous situation. She

[21] Boston M. & S. J., 1886, cxv, 567.

[22] J. Greig Smith, ii, 993.

[23] Eclectic Repertory Phila. 1817, vii, 242.

[24] The Pathology, Diagnosis and Treatment of Diseases of Women. Third edition, London, 1872, 594.

appeared willing to undergo an experiment . . . . and rode 60 miles on horseback in a few days for the purpose. The operation was completed in about 25 minutes. In five days I visited her, and much to my astonishment, found her engaged in making up her bed, ... and in twenty-five days, she returned home as she came, in good health, which she continues to enjoy." M'Dowell's first operation was followed by six others, all but one successful, and between 1809 and 1830, the date of his death, he had operated thirteen times.

Robert Lee[25] published a table of 162 cases of attempted or performed ovariotomy in Great Britain, of which 117 were undertaken before 1847. In 60 patients the ovarian disease could not be removed and 19 of them died from the attempt. Of the remaining 102 cases of completed operation 42 ended fatally. The opinion then held of ovariotomy as expressed by Druitt[26] is that it is "an operation so tremendous that there are not wanting some who condemn it under any circumstances; although the general feeling of the profession seems to be in favour of it, if performed in cases only that are favourable for it."

The successful removal of ovarian tumors through an abdominal incision was soon followed by attempts to remove the diseased uterus in a similar way. Langenbeck,[27] in 1826, undertook to remove a cancerous uterus through the linea alba but the patient died soon after the operation. Several efforts were made to extirpate uterine myomata but all were unsuccessful. Gusserow states[28] that of fourteen cases of exploration, merely, in this disease, five were fatal.

Thus in 1846 the borderland of medicine and surgery had become definitely invaded. For the most part it was a region filled with disability, suffering and despair. The inaccuracy of diagnosis, the uncertainty of prognosis, the dependence upon the healing powers of nature, the occasional relief of symptoms by the physician, acted as a bar against the terror and danger which attended the invasion of the surgeon. The introduction of surgical anaesthesia at once took away much of the immediate mental and physical suffering; terror became fear only, and danger was reduced to risk.

[25] Trans. Med. Chir. Soc., Lond., 1851, xxxiv, 10.
[26] System of Surgery, 422.
[27] Edinb. M. & S. J., 1826, xxv, 241.
[28] Billroth. Hdb. d. Frauenkr., 1878-1882, i, 87.

Ovarian dropsy was a disease which might be treated medically or surgically, but an ovarian tumor at once suggested surgical treatment. The success obtained by Charles Clay,[29] who, between 1842 and 1848, had operated upon 32 patients with ovarian disease with a loss of 10, acted as a stimulus to other operators. Spencer Wells began to operate for this disease in 1858, and published, fourteen years later,[30] the results of 400 operations, showing a progressive diminution in mortality from 34 per cent. to 22 per cent., and without a death among the last 24 private patients. The treatment of ovarian dropsy then became the common property of all surgeons, each of whom felt if such results could be obtained it behooved him to strive for them.

The next in the series of abdominal affections assumed by the surgeon was fibroid disease of the uterus, which the physician was less inclined to relinquish. The symptoms resulting from its presence were often to be relieved by medical measures, its growth might be arrested, its shrinkage take place; it did not necessarily threaten life or cause disability, and the fatality of the operation was extreme. The earlier operators recognized the importance of these considerations, and undertook the operation only when life was rendered miserable or endangered. The first successful hysterectomies were by American surgeons, Burnham, of Lowell, in 1853,[31] and later in the same year Kimball[32] of that city.

In 1866, according to Storer,[33] there had been 24 operations with 18 deaths, a mortality of 75 per cent. In 1874, Schroeder[34] found that the total number of recorded hysterectomies for fibromyoma was 73, with a mortality of 83.3 per cent. Individual operations had a better result, for Péan, in 1876, reported 25 hysterectomies, with 32 per cent. of deaths.[35] The success in the removal of ovarian tumors led the surgeon to undertake the extirpation of the diseased spleen. From 1846 to 1878 nineteen such operations were performed, with sixteen deaths.

Affections of the biliary tract, especially those due to gall-stones, were not considered seriously by the surgeon in the years directly

[29] The Results of all the Operations for the Extirpation of Diseased Ovaries by the Large Incision from Sept. 12, 1842, to the present time, 1848.

[30] Trans. Med. Chir. Soc., 1872, liv, 263.

[31] Nelson's American Lancet, 1853, vii, 147.

[32] Boston M. & S. J., 1855, lii, 248. [33] Am. J. Med. Sci., 1866, li, 110.

[34] v. Ziemssen's Handb. d. sp. Pathol u. Therap., 1874, x, 241.

[35] Clinique chirurgicale, 1876, 690.

following the introduction of anaesthesia. The statement of Frerichs[36] was a sufficient guidance for the physician, viz., that "the great majority of the cases run a favorable course in spite of the occurrence of all the same symptoms. . . . . On the other hand, very severe and prolonged cases of this disease may recover, and this hope should not be yielded prematurely." The surgeon, on the contrary, could take courage in the thought that "it must not be forgotten that there are many unforeseen dangers which threaten life, and that apparently mild cases may suddenly take an unfavorable turn. The possibility of recurrence is to be remembered, since the concretions by no means pass away at once." But American surgery was soon to show that a distended, non-adherent gall-bladder could be opened successfully and its contents evacuated. Bobbs,[37] of Indiana, operated in 1868 upon a patient in whom the distended gall-bladder had been supposed to be an ovarian cyst. Dr. Bobbs doubted the diagnosis, and undertook to remove the tumor. The gall-bladder was opened, the stones removed, the incision closed, and the patient recovered. Ten years later this operation was repeated unsuccessfully by Marion Sims. Thus, the effect of anaesthesia, in changing the borderland of medicine and surgery, was chiefly confined to the treatment of affections of the uterus and ovaries. Gynaecologists and surgeons vied with each other, success lay with the former at first, but the surgeon soon took equal rank with the gynaecologists, and energetically availed himself of the experience and skill acquired by the latter.

The period of antisepsis then arrived, begun by Lister more than forty years ago, slowly progressing through his patient efforts, welcomed by Germany before it made much headway in Great Britain, France, or the United States, but finally adopted throughout the world. Its application to ovariotomy by Keith, of Edinburgh, in 1877, reduced his mortality of 10 to 14 per cent. to 3 per cent., in 1880.[38] Schroeder[39] gives the average mortality as 5 per cent., being somewhat higher for complicated cases and lower for the simpler cases, and Treves,[40] in 1892, gives a mortality of 3 to 5 per cent.

[36] Klinik der Leberkrankheiten, 1861, ii, 510.
[37] Trans. Indiana State Med. Soc., 1868, 68.
[38] J. Marion Sims, Am. J. Obstet. & Gynec., 1880, xiii, 290.
[39] v. Ziemssen's Handb. d. sp. Pathol. u. Therap., 8 Aufl., 1887, x, 43.
[40] Manual of Operative Surgery, 1892, ii, 250.

The favorable results of hysterectomy for uterine fibroids led to the revival of the Caesarean section, as modified by Porro in 1876 and subsequently by Sanger. An operation hitherto so mortal as to be rarely undertaken, in 1888, had a fatality of about 25 per cent. in 135 cases.[41] Splenectomies were so increased in number that Asch[42] collected 40 instances, between 1878 and 1888. He tabulated 90 cases of extirpation for disease, with a mortality of 43 per cent. The fatal cases were those in which the spleen formed a large tumor, and Wright[43] states that the extirpation of the enlarged spleen in 22 cases of leukaemia proved fatal in all but one, and 15 out of 23 patients with simple enlargement died from the operation. The successful outcome of the antiseptic treatment led to the more frequent repetition, from 1882, of operations on the biliary tract. The treatment of gall-stones now entered definitely into the domain of the surgeon and was especially promoted by those in Germany. From the collective statistics of Braun,[44] of 216 various operations for gall-stones the average mortality was 26.3 per cent. Kehr, however, in 28 choledochotomies lost but two patients, a mortality of 6.6 per cent.

Thus the application to laparotomy of Lister's method of treating wounds justified the surgeons in undertaking the gravest operations with but little hesitation. A new specialist in surgery arose, the abdominal surgeon. It lay within his province to undertake the treatment of affections of the stomach, intestine, liver and biliary tract, pancreas, spleen, and kidney, which hitherto had been considered to belong to the domain of the physician as being too hazardous for the surgeon to attempt to relieve. The antiseptic method had its dangers, however, and the necessary limitations to the use of carbolic acid, corrosive sublimate and iodoform were learned. The bacteriological investigations, especially of the Germans, led to the replacement of the antiseptic by the aseptic method of surgical treatment in all suitable cases. In consequence, the last fifteen years have witnessed the unhesitating advance of the surgeon into regions not only of the curable, but also of the incurable diseases. The nearly absolute control of technics and the ingenuity and skill of the operator have so lowered the mortality of the operation,

[41] Schauta, Eulenburg, l.c. xii, 45.
[42] Arch. f. Gynaek., 1888, xxxiii, 130.
[43] Med. Chron. Manchester, 1888, x, 188.
[44] Langenbuch. Deutsche Chir., 1897, xlvi, c, 1te Halfte, 2 Theil, 344.

that in the doubtful affections, the uncertainty or inefficacy of medical treatment, the acquiescence, even the demand of the patient have encouraged experimental surgery apparently almost beyond limit. The surgical invasion of the borderland is, at times, impatient of opposition, and usually resistless. The number of operations at the Massachusetts General Hospital has increased from 385 in the decade before anaesthesia, to 24,270 in the decade following 1894. The mortality of ovariotomy has been reduced to a few per cent. Kelly[45] has had 100 consecutive abdominal hysterectomies, which included all kinds of complications, and lost but two patients. His mortality in 1,000 operations was 3 per cent. Caesarean section has a mortality of less than 12 per cent. At the last session of this Congress Dr. W. J. Mayo[46] stated that in the service of his brother and himself the mortality of 510 operations for gall-stones was 3 per cent., and of 208 cases of stones in the gall-bladder, without complications, the operative mortality was 1 per cent. According to von Bergmann,[47] of 164 splenectomies between 1890 and 1900 the mortality was 18.9 per cent., but in Banti's disease, as stated by Armstrong,[48] the mortality of this operation is 28 per cent.

With due appreciation of the great benefits that have arisen from the surgical invasion of the borderland, there still exists sufficient reason to progress slowly and cautiously. Operative success is not necessarily a justification for the operation, as has repeatedly been recognized by those who are brought in contact with the failures. The removal of a diseased part, and especially of a diseased organ, may dispose of a result, but not of a disease. Splenectomy in leukaemia, despite its almost invariable fatality, has repeatedly been performed. A solitary kidney or a multilocular cystic kidney has more than once been removed, without thought that the patient was being deprived of his only means of living. Operative myxoedema was worse than goitre, although without it we might not so readily have learned the value of thyroid therapy. The extirpation of normal organs has failed to give anticipated relief, and has resulted in disturbances more disastrous than the symptoms for which it was undertaken. The surgeon has learned to know that his knife may prove a two-edged sword, giving relief with the one cut, but with

[45] Operative Gynecology, 1906, ii, 380.

[46] Trans. Cong. Am. Phys. and Surg., 1903, vi, 195.

[47] Syst. of Prac. Surgery, v. Bergmann, v. Bruns, v. Mikulicz. Edited by Bull, Foote, Flint, and Martin, 1904, iv, 676.

[48] Lancet, 1906, ii, 1780.

the other laying the foundation for subsequent disease. Operative success has increased the number of operators as well as the number of operations. But skill in operating is not attained in a day, and requires a long period of preparation which is impossible for every one who would become an operator. The multiplication of small hospitals gives surgical opportunity, but this does not make the surgeon.

In the earlier days, the separation of surgery from medicine was caused by such an immediate and large demand for surgical treatment that the practitioner was encouraged in obtaining his education as quickly as possible. With little or no preliminary preparation, and with very limited practical instruction, he was sent to the wars, or was left to take the place of those who had gone. Such surgeons, with rare exception, accomplished nothing to advance the cause of surgery. In these days, on the contrary, the demand for the surgeon is due to the improvement in his art. It is for the leaders to be mindful that in broadening the field, the breadth of the surgeon should not be contracted. Fortunately, in this country, education in medicine is demanded of all, whatever the ultimate practice may be, but the tendency to specialize is apt to begin too early. All may not agree with Senn,[49] who advises the expectant surgeon to "master the elementary branches in college, do general practice for several years, return to laboratory work and surgical anatomy, attend the clinics of different operators, and never cease to be a physician. If this advice is followed there will be less unnecessary operating done in the future than has been the case in the past."

The skilled surgeon has but little more to strive for in operative success in many operations, but his usefulness will be greater who knows when not to operate, and whose researches discover means by which operation may be made unnecessary. Billroth said,[50] "Before deciding on the necessity for an operation, I always propose to myself this question: 'Would you permit such an operation as you intend performing on your patient to be done on yourself?' Years and experience bring in their train a certain degree of hesitancy."

The responsibilities of the surgeon never have been greater than at the present day. The final decision usually rests with him, and the physician is only too ready to be relieved of his burden. The

[49] Monthly Cyclopedia of Practical Medicine, 1905, viii, 2.
[50] J. Am. Med. Assoc., 1905, xliv, 787.

ease of making the diagnosis after the operation not infrequently leads the surgeon to undertake it with too little forethought of what is to be encountered. He is inclined to be satisfied that for therapeutic purposes an operation must be performed. His skill in diagnosis, however, should transcend that of the physician, since his opportunities of control are furnished by every operation designed to relieve the patient, while those of the physician are limited largely to the post-mortem examination of the patient beyond relief. The operation is permitted, the autopsy often is denied. The therapeutic test of diagnosis offered by the physician represents essentially a sequence of events, that carried out by the surgeon is one of cause and effect. The biopsy of the surgeon has added valuable knowledge to the necropsy of the anatomist, but it is not infallible. The operation of the pathologist is exhaustive, that of the surgeon is limited, and the decision ultimately must rest with him who has the larger opportunities. This constancy of control should make the surgeon especially cautious and thorough in his investigation, particularly in the borderland cases, for upon the accuracy of his diagnosis the future of the patient is to depend.

The surgeon has even greater obligations than those which arise from taking every possible means of making a correct diagnosis. His operative mortality may not be as low as that of the most successful, or as high as that of the beginner. It should be his best, determined by every conscientious and intelligent effort to perfect it. As surgeon, and not merely as operator, he is to satisfy the physician that the ultimate welfare of the patient is to be enhanced rather by surgical than by medical treatment. The lower his personal operative mortality, the more permissible is the trial of surgical measures. But the outcome of any operation, however simple, always has the element of uncertainty, and the existence of a medically irremediable morbid condition is not a sufficient reason for an operation. As Treves says,[51] "If the mortality attending ovariotomy were to be increased threefold beyond the present percentage, the operation would still be justifiable, inasmuch as the death-rate in untreated cases is so high as to leave but little prospect of life. On the other hand, were the death-rate of hysterectomy lower by threefold than it is, it would not sanction the performance of that operation on account of a small fibroid tumor which had ceased to grow, which produced no

[51] L.c. 1, 2.

symptoms, but which the patient, as a whim, was determined to be freed from." A knowledge of the natural history of disease, therefore, is essential, and it is not to be forgotten that the latter has been the object of study for several generations before the aseptic period, and should be familiar to every surgeon. It is known that all cysts of the ovary are not proliferating cysts, nor do they necessarily attain a size productive of disturbance. Innocuous myomata of the uterus are so common after middle life that frequently they are to be regarded rather as abnormal than as pathological attributes. Because malignant disease of the uterus is associated with some of these, it does not follow that all fibromyomata should be removed through fear that they may become malignant. Gall-stones are present in a large number of cases of cancer of the gall-bladder, but they are oftener found when there is no cancer of this organ, and it is a questionable argument for their removal that they sometimes are present in this disease. Gall-stones in this relation are quite as likely to be the result as the cause of the cancer. The physician will have greater confidence in the judgment of the surgeon when he knows that the latter is qualified, by the thoroughness of his knowledge of pathological anatomy in general, to give due weight to the natural history of disease, and is not unduly impressed with contingencies which may happen, but of which there is no apparent prospect. But if the possible extent of the relief is limited, or new dangers are likely to arise, it becomes a serious question whether the temporary advantage of the few is compensated for by the permanent detriment of the many. In such cases it is the future of the patient which is to offer the means of discriminating between a useful and a useless operation. When operations were fewer this was to be observed by the physician. With the great increase in the number of the surgeon's operations, it is for him to keep informed of the subsequent history of the patient, and to be able to justify his action by a recognition of its effects, not for weeks or months only, but for a lifetime, whether this is to consist of weeks, months, or years.

The wise surgeon thus selects from the borderland those cases which the physician has in vain attempted to relieve. He has taught the latter repeatedly that greater accuracy in diagnosis is attainable, that medicinal efforts for the absorption of an exudation or the removal of a growth are usually a waste of time. He has demonstrated that the continued use of opium for the relief of pain may

mask a purely mechanical disturbance, to be definitely relieved only by mechanical measures; that the control of fever by antipyretics may prove a snare and a delusion; that prolonged jaundice is not to be cured by medicines; that obstinate vomiting does not necessarily demand a sedative, or persistent constipation a laxative. The diminishing reliance of the physician on treatment with drugs is significantly shown by the records of the Out-Patient Department of the Massachusetts General Hospital. According to Böhm,[52] the number of prescriptions for drugs diminished from 68,143 in 1900 to 43,063 in 1906, more than one-third, while the daily average of patients increased from 298 to 325. This change has been brought about by the introduction of the various appliances for physical therapeutics. In 1903, a daily average of 42 patients was treated entirely or chiefly by these measures. Thus the physician is led to recall the teachings of Hippocrates, that suitable diet, appropriate exercise, proper clothing, and quiet of mind are important not only in the maintenance of health, but in the recovery from disease.

The successful invasion of the borderland by the surgeon is due mainly to the fact that surgery has become a science. The scientific surgeon, like the scientific physician, will have cause to glory in his name, which has sometimes been used in reproach, provided he has always before him the thought of applying his science for the relief and cure of disease. Scientific methods are to be acquired in the laboratory only, and the leaders in medicine of the present day realize that the laboratory has become quite as important in education as the clinic. They recognize that it is not the number of patients the physician or surgeon sees which makes his opinion valuable, but the sort of consideration he is able to give the individual patient. The ideal surgeon, therefore, seeks his early training in anatomy and pathological anatomy, in histology, physiology and pathology, in chemistry, physics and bacteriology, and thus prepared, becomes the more successful in his encounter with disease. A like training is demanded of the physician, and the conjoint efforts of both are needed in the search for means of making future operations less necessary. It is always to be remembered that the origin of antiseptic surgery and its transformation into aseptic surgery are largely the outcome of laboratory methods in bacteriology, and that the development of this science has been especially

[52] Boston M. & S. J., 1907, clvi, 178.

productive in the progress of medicine. Numerous discoveries in the etiology of disease, its methods of transmission, its prevention, the origin of symptoms, accuracy in diagnosis, and precision in treatment, are the outcome of bacteriological research. The ultimate extension of the borderland of medicine, the corresponding limitation in the field of surgery, and the discovery of means of making many operations unnecessary, seem most intimately connected with further progress in this science.

Biological chemistry, allied on the one hand to physiology, on the other to bacteriology, gives promise of a more accurate understanding of the nature of vital processes in relation to health and disease. It also permits the early recognition of remediable disorders and the control, if not cure, of those which have passed beyond the initial stages. The dependence upon the laboratory never ceases. The laboratory of pathological histology is an adjunct of the operating room, the bacteriological laboratory has become a necessity of the clinic, and the laboratory of the workers with the Röntgen ray is essential in diagnosis and treatment for physician and surgeon.

The training of the student in medicine in the scientific laboratories leads to his fullest preparation in the laboratory of clinical pathology, the clinical laboratory of the school in contradistinction to the greater clinical laboratory, the hospital. In the former he is to utilize all the methods of scientific observation, analysis and experimentation obtained in his earlier education that he may apply them in the latter to the diagnosis and treatment of disease. It is through the use of these methods that he is to recognize his opportunities and his limitations, to improve the former and to lessen the latter. Through them he is to fit himself the more thoroughly to give his patient the benefit of medical or surgical methods in the treatment of the particular ailment.

The amount of knowledge to be obtained along these lines is without limit, the immediate value indefinite, but the promise is incalculable. The unselfish devotion of the workers, and the general appreciation of their labors are meeting a reward not only in the good which has been accomplished, but in the substantial aid which is being received from public and private sources. In this country, in particular, private munificence has set an example which makes the older world envious, and there can be no more profitable investment than that which makes all mankind its debtor.

Thorough training in the laboratories is the best preparation for contact with disease. Many of the problems the latter offers

remain unsolved, are steadily renewed, and can only be simplified by the return to laboratory methods of investigation. The solution often requires experimentation, and the more clearly defined the conditions the more definitely attainable the answer. Many such problems are to be found within and without the borderland, and the more complete the preparation of the physician and surgeon, the more skilful and beneficent their art, the more exact and the more productive their science.

The following works have been utilized:

Freind. The History of Physick. 3d edition. London, 1726.
Girodat. Recherches critiques et historiques sur l'origine, sur les divers états et sur les progrès de la chirurgie en France. Paris, 1744.
Sprengel. Histoire de la Médecine. Transl. par A. J. L. Jourdan, Paris, 1815.
Johnson. Life of Thomas Linacre. London, 1835.
Futvoye. A. Cornelius Celsus of Medicine. Transl. by James Greive. Revised with additional notes by George Futvoye. London, 1838.
v. Siebold. Versuch einer Geschichte der Geburtshülfe. Berlin, 1839-45.
Adams. The Seven Books of Paulus Aegineta. Transl. by Francis Adams. London, 1844.
Renouard. History of Medicine. Transl. by C. C. Comegys. Cincinnati, 1856.
Russell. The History and Heroes of the Art of Medicine. London, 1861.
Meryon. History of Medicine. London, 1861.
Daremberg. La Médecine, Histoire et Doctrines. Paris, 1865.
Raynaud. Les Médecins au Temps de Molière. Paris, 1866.
Haeser. Lehrbuch der Geschichte der Medicin. 3d edition. Jena, 1875-82.
Fort. Medical Economy during the Middle Ages. New York & London, 1883.
The Healing Art. London, 1887.
Puschmann. A History of Medical Education. Transl. by Hare, London, 1891.
Payne. Thomas Sydenham. New York, 1900.
Puschmann. Handbuch der Geschichte der Medizin. Herausgegeben von Neuburger und Pagel. Jena, 1902-1905.
Minvielle. La Médecine au Temps d'Henri IV. Paris, 1904.